JUDGING POULTRY FOR PRODUCTION

JAMES E. RICE,
GOLDAN O. HALL AND DEAN R. MARBLE

POULTRY SCIENCE SERIES

EDITED BY

JAMES E. RICE

PROFESSOR OF POULTRY HUSBANDRY, NEW YORK STATE COLLEGE
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Judging Poultry for Production

By James E. Rice, G. O. Hall, and D. R. Marble. A development of the principles of judging poultry for vitality and for production and of the relation of these to the judging of fancy poultry. Cloth; 6 by 9 inches; 425 pages; 205 figures.

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FRONTISPIECE

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and
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FOREWORD

This book aims to help bring about a better knowledge of how to judge poultry for vitality and production and to develop a sympathetic understanding of the relationship between those whose principal interest is commercial poultry and egg production and those who are responsible for the development of fancy poultry. It overlaps the judging of poultry for standard qualities only in discussing breed defects as an important step to be taken in the efficient selection of the most profitable types of poultry. It leaves to others—the standard makers—the exclusive field, and the responsibility for continuing to lead the way, as they have been doing for many generations, in developing the standard qualities of the many breeds and varieties of poultry. Standards should be sponsored by responsible organizations rather than by individuals in order that they may be truly authoritative.

Each country or group of countries should have, and many do have, breed standards. In the United States and Canada this responsibility is handled cooperatively by the Breed Specialty Clubs and the American Poultry Association as a correlating agency. The reader is therefore referred to the American Standard of Perfection as authority for guidance on all matters relating to standard quality.

Standard bred poultry actually bred for production should furnish the best foundation upon which to build a sound breeding policy.

The purpose of the authors in undertaking to assemble, interpret and classify the information available on the subject of Judging Poultry for Production has been to assist the great mass of poultrymen and poultry women to gain a clearer understanding, and therefore to have a greater appreciation, of the possibilities and the limitations of our knowledge and of the ways in which poultry may be judged with respect to their production values.

The Field

The field of judging poultry for production is well defined. It assumes to interpret the production values of birds as revealed by physical characters. This is a restricted field. But in order to interpret most accurately the physical characters of birds, as indicating their vitality and production, it is helpful to know as much as possible about their inheritance and environmental conditions, which greatly influence the physical characters. In order to do this most efficiently it is desirable not only to know how birds differ in their production characteristics but also to understand certain principles and practices in management. It is necessary to know the cause as well as the effect. Hence, it is necessary to discuss the ways in which breeding and management may influence production. To that extent, and for the reasons stated, this book discusses only incidentally the closely related subjects of climate, feeding, breeding, illumination and general management.

Since judging for production presupposes a knowledge of many of the breed and variety characteristics, it requires a properly qualified production judge to be well informed on standard values, the same as the standard judge should be equally well informed on production characteristics. It follows, therefore, that the best qualified judge and the most efficient breeder will need to study both phases of the subject.

Frankness

The authors have endeavored to discuss fairly and frankly all controversial questions coming within the scope of this book. They have been as free to admit the limitations to production judging as to champion its advantages. In doing so they have been fully conscious of the fact that no one is infallible. The constant effort has been to interpret the true and the false correctly in the belief that we are all seeking the same end—the truth. On this account, the publication of this book has been long delayed. There have been and still are many points which we do not know, or about which we are still in doubt. The authors venture to express the hope that the readers will understand that the book is offered not as a finished product but more in the light of a report of progress—to be continued as more facts become available, on which to draw conclusions. It is hoped, however, that sufficient facts have been assembled and conclusions drawn to make the book a helpful medium for raising the standard of the quality of poultry wherever the book is read to the end that those who keep poultry may do so with greater profit and keener intellectual satisfaction.

Credit

The authors have endeavored to give full credit for ideas, and illustrations used and for the many contributions made to our knowledge of the subject. Notwithstanding the effort to portray accurately the individual contributions of the great army of conscientious scientific workers and keen practical observers whose efforts have made possible the science and art of judging poultry for production, it is inevitable that some important omissions have occurred or inaccuracies have crept in. If so, the authors will be grateful for any suggestions that will make for completeness and accuracy.

THE AUTHORSHIP

The authors have been associated in the same Department for many years as teachers, investigators, extension workers and judges. Each author has the background of many years' experience in the practical handling of poultry for profit. In writing this manual each author has been responsible for preparing about one third of the chapters.

All chapters, however, embody the combined ideas and composition of all three authors. On all debatable questions discussed in the book the authors are unanimously agreed and individually and jointly assume full and equal responsibility for all ideas expressed, except matter quoted.

THE IDEAL

The ideal which the authors have kept constantly before them is expressed in our creed here quoted, which is commended to others as a platform on which the true fancier and production breeder everywhere can stand and unite their forces for the improvement of poultry and the upbuilding of the industry.

OUR CREED

To make the useful more beautiful and the beautiful more useful is the highest ideal of the breeder.

To combine properly into one harmonious whole the most useful with the most beautiful without sacrificing the ideals of either calls for the soundest science and the finest art of breeding.

Its accomplishment, therefore, is the ultimate measure of man's mastery of the forces of nature as applied to the improvement of living things.

THE AUTHORS.

APRIL, 1930.

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Part One

PRINCIPLES OF PRODUCTION JUDGING

JUDGING POULTRY FOR PRODUCTION

CHAPTER I

INTRODUCTION

WHAT THE SCIENCE AND ART OF JUDGING POULTRY FOR EGG AND MEAT PRODUCTION MAY BE EXPECTED DIRECTLY AND INDIRECTLY TO ACCOMPLISH

THERE are five major benefits of judging poultry for production.

1. *To Cull out the Low Vitality and Diseased Individuals from Baby Chick to Mature Stock.*—By so doing six objects are accomplished.

(1) It helps to prevent the spread of diseases and parasites by removing the carriers.
(2) It reduces the number of birds and thus saves labor.
(3) It increases the average quality of the birds retained in the flock and therefore raises the average production.
(4) It avoids feeding unproductive birds and hence reduces the cost of egg production.
(5) It reduces the labor cost per bird and thereby permits better care and less crowding.
(6) It increases the average profit per bird by reducing costs and increasing the total net income.

2. *To Grade Pullets According to their Approximate Laying Probabilities into Culls, Commercial Producers, R. O. P. and Contest Layers, and Prospective Breeders.*—In addition to the regular job of culling the pullets, they may be further judged for vitality, growth and production on evidences of early versus medium or slow laying maturity and for freedom from standard disqualifications. By so doing the flock will be still further reduced in number, thus raising still higher the average quality and production value.

3. *To Select Cockerels According to their Approximate Possibilities for Immediate Consumption, for Market, for Further Development or Prospective Breeding.*—Since cockerels can be judged much more quickly, easily and accurately many months younger than pullets of the same breeds and varieties it is more profitable, and therefore more important, that they be rigidly and frequently graded in order that they may be used to best advantage according to their respective qualities.

4. *To Segregate Layers into Several Different Grades of Approximately Uniform Laying Quality within Each Grade.*—With hens, even more than with younger birds, it is possible to eliminate the unprofitable and to segregate the others into flocks according to their laying ability. Here, perhaps more than in any other respect, a knowledge of selection can be used most profitably from the standpoint of efficient feeding. *Flock segregation* should become a household term. It is one of the most important of the modern practices. It is made possible by our newer knowledge of judging poultry for production.

5. *To Select Males and Females of Most Promising Potential Prepotency for Pedigree Breeding.*—Here, perhaps less than in the four preceding applications of the principles of judging for production, it is possible to predict the accuracy of results. The reason for this difficulty is that birds that are good producers are not necessarily successful getters of good producers. How to predict what the offspring from any particular bird will do is a difficult question to answer. The problem has not been satisfactorily solved: One reason, although not the only one, is that in every mating the responsibility for inheritance is divided between two individual units, the sire and the dam.

Judging for Prepotency is Long-distance Forecasting.—The judging of pullets for production is *prophecy* since it predicts *future performance*, and the judging of hens for production is *history* since it is based on *past performance*. Therefore, the judging of males and females with regard to their prepotent ability to transmit their good qualities to their sons and daughters is the most difficult prophecy since it is long-distance forecasting. It is predicting one generation ahead of the two individuals examined, a male and a female. The judge, therefore, must have a keener discrimination and longer vision than is required in any other type of judging.

For that reason, few, if any, judges would care to assume the responsibility of trying to predict with any great degree of accuracy the prepotent power of either male or female. So far as is known there appears to be no other key to the mystery of inheritance or prepotency, that will unlock the combination, except *pedigree mating* and *progeny testing*.

Here then the laws of inheritance, rather than the physical appearance and actions of the birds, must be depended upon to answer the question as to the comparative and actual prepotency of either male or female.

Sex Action by Laying and Mating Should be Our Guide.—However, there are certain masculine and feminine characteristics which mark certain birds as having unusual procreating qualities as exhibited by exceptional sex-conscious males and pronounced persistent laying females which may be accepted now as our best estimate as a possible indication of prepotency. The more pronounced is the evidence of procreation on the part of a male and the laying qualities—" the urge to lay "—of the female, the more reasonable it is to assume that these qualities have become intensified and fixed so that they may be expected, other conditions being equal, to dominate the genetic composition of the mating. Even this possibility has not been fully demonstrated as a scientific fact.

The first four of these important objects can be, and are being accomplished in a very large measure by thousands of persons who have studied the principles of judging by physical examination and who put their knowledge into successful practice.

The fifth object, judging for prepotency, is helpful at least in selecting the best prospective layers by physical examination to be checked by progeny testing. To that extent it is decidedly helpful.

A GREAT AND RAPIDLY GROWING NEED FOR THE LATEST KNOWLEDGE OF PRODUCTION JUDGING

The number of persons who are properly informed in the science and art of judging by physical characters is surprisingly small as compared to those who are not.

It is certain, therefore, that vastly greater economic gains will be made in profitable poultry keeping when the great mass of poultrymen and women everywhere learn to recognize good producers from poor producers, and high vitality from low vitality birds when they see them. This one accomplishment, without doubt, has greater potential possibilities for increasing net profits, reducing the hazards and expanding the value of the industry as a source of national wealth than any other single improvement.

EFFICIENT STOCK THE MOST IMPORTANT FACTOR IN PROFITABLE EGG AND MEAT PRODUCTION

The fundamental reason for placing such large emphasis upon the judging of poultry for vitality and production quality is the fact that upon the efficiency of the poultry unit, the living machine, like that of every other machine, depends the profit to be secured from the "raw material," the feed and labor used in the manufacture of eggs and meat.

Here then is the place to begin: with either the bird—the layer—the breeder—the egg—or the chick. With properly selected high vitality stock as a strong foundation one is justified in constructing modern buildings, purchasing the most up-to-date equipment for breeding, incubation, brooding, laying, fattening, sanitation and marketing, but without a safe foundation of efficient stock all else is of little or no avail. If the electric transformer is wrongly constructed or is out of order the current does not flow and the motor does not work. We must keep constantly in mind that the bird as a producer is our transformer of raw materials into finished products, eggs, meat and beautiful birds.

They are what we make them. A bird is the reflection of man's intelligence and industry. They are no better than our ideals. It is within our power to make or break any breed or variety. Progress is upward, not downward. Our breeds and varieties of poultry are, for the most part, constantly improving. Many are disappearing and no amount of advertising will bring back their vanishing popularity. They need better breeding rather than more advertising. Other breeds and varieties are gaining in importance by leaps and bounds. They pay better dividends. Here that great natural law of universal application to all living things, the law of the "survival of the fittest," applies.

Rapidly Changing Ideals and Higher Standards

These trends in the breeding world do not just happen. They are brought about by the slow process of changing ideals which create the demands of the buying public.

It must be apparent to all that the public demand now is like a constantly rising tide for birds that combine to the highest possible degree the most profitable production of eggs and meat without sacrificing man's natural love for beauty of form, color and action.

The Shift of Public Opinion and Demand Has Been from the Fancy to Production and Part Way Back

The pendulum of popularity, as usually is the case, has swung too far in each direction. First we had only the exhibition. Then many swung to the opposite extreme and emphasized only utility. Now the pendulum is swinging back toward a proper balance between the two, the useful and the beautiful. This is as it should be. The shift of sentiment, however, has played havoc with the breed and variety creations of the past century or more, when the main objective of poultry breeders was to create new breeds and varieties almost without number.

The Old Order Gives Way to the New

The host of varieties which have had their day and now are slipping in popularity have served a useful purpose for many generations. Many of these varieties are triumphs of the breeders art. Many men and women gave much in time, money and study to the perfection of their favorite varieties of poultry. This was a genuine work of love. The originators received their reward principally in personal satisfaction. Many, however, added profits and rendered a useful service in exhibiting, judging, producing and selling pure-bred varieties which now no longer have a commercial appeal.

A Shift in Ideal from the Fancy to Beauty Plus Production

The decline of many varieties of poultry which were once popular does not justify the assumption that they did not possess merit. On the contrary, they may have possessed a large measure of merit, for the purpose for which they were created—a work of art—in color pattern, stately carriage, beautiful symmetry, graceful action and normal egg and meat production. They still fill this rôle with distinction and may continue to occupy their " place in the sun."

Some of these varieties will be used as the foundation upon which to build genuine egg and meat production values and still will retain much of their fancy exhibition quality. Whether they attain the highest goal of accomplishment in poultry development—a maximum of production efficiency combined with a maximum of standard beauty—will depend, to a considerable extent, upon how exacting are the standard requirements, that is to say, how many birds will have to be discarded because of standard disqualifications or defects that otherwise possess high production qualities and, conversely, how many of the birds which possess high standard exhibition qualities will have to be discarded because they lack production values.

From this equation with a multitude of breed and variety characteristics on the one side, and many production qualities on the other side, it becomes a question of canceling on each side the least important requirements in order to reduce our breeding formula to lower terms so that we will have as many as possible of the best all-round breeders left in the breeding flocks.

SIMPLIFY IN ORDER TO INTENSIFY

In the poultry breeding equation, as it is with all other formulas, the simpler the terms the easier it is to reduce the equation to lower terms. It naturally follows then that the breeds and varieties which require the greatest skill to bring them to standard perfection requirements offer the greatest obstacles to their use in developing high production values. This is due to the fact that the less attention one must give to standard requirements and still meet a high degree of essential standard quality the more time and effort can be devoted to production values, which being applied practically, means those varieties that are easier to breed reasonably true to production values. Examples of such cases are found in the varieties which have difficult plumage requirements to maintain because of feather pattern, uniform plumage, surface color and under color; exaggerated tail carriage, or persistent standard disqualifications or exacting shades of uniform colors for the male and female, which is opposed to the natural tendency for the sexes to have different shades of color; or to require a body size or shape which is not in conformity with the most productive long-lived birds producing the highest quality of product. These and many other requirements, however valuable they may be from the standpoint of scientific breeding to secure perfection from the exhibition standpoint, develop breeder resistance from a production breeding standpoint.

WHICH SHALL IT BE—MAJOR IN THE FANCY AND MINOR IN PRODUCTION OR THE REVERSE?

The standard requirements of some of our most valuable varieties of poultry are such that they are perpetually handicapped in either one or both of two directions. Either the standard requirements are likely to be so difficult or so inconsistent to breed true and maintain that too few birds are left for breeding which also meet the production requirements, or else, on the other hand, so many birds which meet the production requirements but do not measure up to the difficult standard requirements that the birds present a motley and unattractive appearance. The remedy is to simplify and harmonize standard requirements so as to conform to business demands for production in order to permit greater attention to be given to production requirements.

Each Must Go Half Way

The ideal breeds for the future must combine to the greatest practicable degree well balanced beauty and production. This policy of simplification is difficult to carry out since it involves two long established different standards—(1) Beauty; (2) Utility.

Slow but steady progress is being made in spite of these handicaps in bringing up at the same time reasonable standard requirements and essential production values. It seems reasonable to assume therefore that with the advancement of the welding process, that is, breeding higher production qualities and more consistent standard exhibition qualities into our most popular breeds, the two ideals more and more will react favorably upon each other and as a result there will be evolved a higher quality of " standard bred—production bred " poultry than we have at the present time.

The Farm and the Show Room are the Cradle and Forum of the Judging World

The judging of poultry for production is not confined to the show room. In fact by far the most important and most extensive judging is on the rearing range and in laying and breeding pens. Here day by day, throughout the year, birds from baby chick to mature stock, of all grades, are constantly under observation under known environmental conditions. Home judging therefore not only is more important in its direct and ultimate benefit to the industry but it also is the most accurate. Home judging is the only foundation upon which high quality poultry shows can be maintained.

This principle is equally true, of course, whether applied to the standard or production show. The logical conclusion therefore is that the more poultry breeders and poultrymen generally know about how to judge poultry for standard and production qualities the greater will be the progress in improving the quality of their stock and by virtue of their greater knowledge and better stock the more likely they are to want to compare their skill as breeders with others.

The place to begin, therefore, to increase exhibitors and visitors at poultry shows or entries at Egg Laying Contests is for poultrymen to learn how to judge and breed poultry more successfully. In order to do this two things are essential: (1) To learn what is known on how to judge poultry. (2) Handle fowls in order to apply the knowledge. There is no other way except to understand the reason why and then to learn how to use the knowledge by applying it. " Learn by doing."

It is inevitable that education is the foundation and the only foundation upon which the most progressive and successful poultry industry can be built.

SINGLE VERSUS DOUBLE STANDARDS OF JUDGING

Notwithstanding positive opinions to the contrary there are two distinct systems of judging. The first is standard exhibition judging. This system is *empirical* and fixed, and deals with characters which are visible. They are the standard requirements of our different breeds and varieties of poultry as they have been developed and clearly defined in the American Standard of Perfection. This is an important phase of judging. It requires remarkable skill, an artistic eye, a splendid memory and ability to visualize how closely the bird, when in its most perfect physical condition, resembles the ideal which man has set up in the Standard of Perfection.

The Second System is Judging for Production

Production judging consists of *interpreting the changing conditions* of the *variable physical characters*, as well as the fixed characteristics of birds in order that one may read the history of a bird's laying performance and hence either to *prophesy* what its production is likely to be or to *estimate* what its production has been.

The Two Systems Should be Combined

The production judge in applying his knowledge of these fixed or variable characteristics, as a result of practical knowledge, and a desire not to do injustice to exhibitors, should recognize and give proper value to the important standard characteristics that define the breeds and varieties as well as to the production values. The time must come, and it is rapidly approaching, when all judges whether they are fancy exhibition judges or production judges, *must combine the knowledge of the two systems of judging and apply it.* The only excuse for having two classes of judges or two classes of shows or a combination of these two is because the two groups of judges have not yet fully understood each other's points of view and have not qualified as all-round judges. It is inconceivable that in a sound system of judging we should have two judges to place awards on the same birds. The solution of the difficulty is the dual education of the exhibitors and the judges. Each class of judges must be properly informed as to the requirements for each class of judging and then must combine these into one operation—one job. The production judge must give more consideration to those qualities that have to do with breed characteristics; and the fancy exhibition judge must learn to apply our present knowledge of production values in judging standard exhibition birds. It is necessary that each shall recognize the principles of production judging and also the importance of breed characteristics.

Production Judging is More Difficult than Standard Exhibition Judging

As between the two classes of judging, the judging for production calls for *greater skill* because the production judge must not only compare the characters which he actually sees as conforming to a fixed breed standard but he is *compelled* to use well-balanced judgment regarding the fixed characters and have *clear insight* in interpreting what the physical changes in the variable characters may mean at all times of the year, when the bird is in varying conditions of production and non-production. This calls for a sound knowledge of the philosophy of judging for production in interpreting the significance of the physical factors. Production judging requires not only a knowledge of what is, but why it is.

A RIGID THEORETICAL PRODUCTION STANDARD IS IMPOSSIBLE

In production judging as in fancy judging there is a real *danger of accepting the shadow for the substance,* namely, the danger of setting up an empirical production standard defining what a bird must be to be a high producer or a low producer. This the fancy standard makers have done in defining how one breed and variety differs from another. A clearly defined rigid theoretical production standard could be set up embodying our best knowledge of egg type, but it would not be correct unless it conformed in minutest detail to many of the best examples of our highest long-distance producers. Otherwise, it would be too artificial, a man-made standard. A production standard can not be a guess based upon theory. A true production standard must be a nature-made standard and cannot be artifically and arbitrarily created. The high producers create their own standards. They are what they are because they inherit the right combination of characters to be super-producers. When we have enough of these on which to describe accurately a composite of the characteristics based upon detailed measurements of super-producers in the different breeds then, and not until then, will we have a scientifically *constructed* standard for production.

Such a standard still must be a variable standard in order to meet the different physical changes which birds undergo during their lives influenced as they are by their production and environmental conditions. In production judging the bird must be judged as he or she is at any and *all seasons of the year*. The bird must be judged when in production or out of production, old or young, male or female. Every bird presents a decidedly different appearance at different times, day by day and year by year. The production judge must recognize the real value of the bird under all conditions. He must accurately interpret the way any variation in type and other physical characters influence production.

The production judge must recognize a fundamental principle in all livestock judging and breeding, namely, that in the evolution of the breeds nature will fix her own standards, which most closely conform to its most efficient performance. Hence the job of the judge is to interpret approximately what a bird's performance has been or is likely to be based on the changes that take place from time to time in its variable physical characters.

PERFORMANCE REFLECTS INHERITANCE OF FECUNDITY AND TYPE

Performance is of equal if not greater importance than type, since it is the active factor and type is the passive factor. Performance is the machinery at work; type is the factory in which the machinery is installed. Each factor is essential to the efficiency of the other.

The *inheritance* of the laying tendency therefore is a most important factor in the judging of birds. We must be able to interpret the variable characters of *molting, pigmentation*, etc., as to whether or not the bird has actually delivered the production. The only true standard of body type therefore must be based on the fact that the bird is or has been a high producer, and not what a judge thinks she ought to be. Even if we have decided upon the ideal egg laying type it does not necessarily follow that the bird having the best egg type will be a high producer. Now this clearly implies that eventually if one follows the policy of breeding his birds strictly in accordance with their performance, vitality and size, those that have laid the most eggs of large size and right shape and that are the best getters of pullets of similar quality, generation after generation, we will find that all breeds and varieties of poultry bred for efficiency of production will have a tendency to approach a common type, i.e., the egg-laying type. The man-made artificial breed types as they have been set up arbitrarily will gradually change and become molded over into the type that is best able to deliver the most and best eggs and chicks. Man can fix the feather pattern, shape of comb, color of skin, eye, etc., to conform with his fancy; but the type of body and size of bird, the primary and secondary sex characters, that eventually will develop and prevail in the most efficient egg producers, must be essentially similar for all breeds and varieties.

LEARN THE SIGN LANGUAGE OF THE BIRD

Our problem therefore is to learn the production judge's alphabet which spells the physical characters of the birds. We must begin where children begin in school. We must learn to read the alphabet of the bird. The A, B, C's of the production judge's alphabet are for example: (A), the molting characteristic is one letter; (B) the pigmentation characteristic is another; (C) the comb characters and (D) skin texture, quality; (E) body type and physical changes; (F) the physical condition and (G) the nervous energy, etc. We must learn to put these elementary letters together into words and spell out the sentences. When these letters are properly understood they will describe the laying quality of a bird. If a person knows the significance of the letters of each word, even to the punctuation that goes into the sentences, he can clearly read the meaning.

A SIMILAR CONDITION OF PRODUCTION IS ESSENTIAL FOR ACCURATE COMPARISON

In order to judge correctly the production value of birds we must appreciate the full significance and importance of having birds in a similar laying condition for comparison. Failure to do this accounts for much of the error and disagreement in interpreting the data secured in studying the physical characters of birds as indicated by their production. The first step to be taken therefore in judging birds is to determine whether a bird is laying or not laying, or just ceasing to lay or just coming into production. The changes which take place in the same bird under these varying conditions are so great that one would scarcely recognize the bird as the same individual. Then compare the birds which are in a similar condition and make proper allowance for the others.

A COMPOSITE JUDGMENT IS ESSENTIAL

We must conclude then that the best judge of poultry for production values is the one who gives proper consideration and weighted value to all of the characteristics of the birds that he is judging. It is easy for any judge unintentionally to make the mistake of placing major consideration upon molting or pigmentation or body type or head characteristics or any one or a combination of these or other characters and let that one character dominate his judgment. What we must do and can do only after many years of experience is to be able to interpret correctly all values in birds as we see them. It is the well-balanced composite judgment of all of the characters which will enable a judge to estimate most accurately the laying or meat value of a bird.

THE FINAL OBJECTIVE IS HUMAN PROGRESS RATHER THAN POULTRY IMPROVEMENT

The favorable reaction upon the one who is responsible for the creation or improvement of any breed of animals or variety of plants is of more importance to the world than the object accomplished. Birds are but the tools of men. They reflect our handiwork. They represent our stewardship.

CHAPTER II

THE HISTORY OF JUDGING POULTRY FOR PRODUCTION

WHEN JUDGING POULTRY BEGAN

The first keeper of poultry was the first judge of poultry. The first act of possession is the mental process of selection. Selection involves decision. Wise decision requires the exercise of good judgment and good judgment is based upon a knowledge of comparative quality. The early judges of poultry therefore, it is assumed, based their choice of birds upon some one of several qualities which would best meet their primitive needs. These needs, insofar as they can be learned from early records or surmises, were five in number. Named in their natural sequence they were: (1) To satisfy the sporting instinct, for fighting; (2) to retain possession, that is, to domesticate and retain at home; (3) to satisfy a love for gay colors and unusual types, thus showing an elemental sense of beauty; (4) to satisfy an appetite for delectable meat; (5) to lay eggs to fill an important need in the human diet.

Although arranged in the assumed order of their importance in the evolution of the domestic fowl, all of these five main objectives have been accomplished, in greater or lesser degree, from the beginning of domestication to the present time. Long epochs of time have been involved in the evolution of the domestic fowl, during which time first one and then another of these main objectives was dominant as a motive for selection; in some countries, depending upon their advancement in the science and art of agriculture, the first stages still prevail, whereas in other countries the first two, three or four, or all five stages have been reached.

In some countries, for example, selection for fighting still is the main consideration. There the combative dispositions, courage, endurance, grit, heavy wings and thighs were and still are the principal requirements in breeding the domestic fowl. The types picked are those which have demonstrated their superiority in the qualities desired for combat.

Always, of course, it has been necessary in order to attain each of the five objectives to select birds on account of domesticity as demonstrated by their preference for association with man rather than for a habitation in the wild and of their knowing enough to "come home to roost."

Man's inborn love for the beautiful, without doubt, had a stronger primitive appeal than the desire for more attractive poultry for food. Wild fowl could be found in abundance. Why bother to keep it in confinement? In other words, man apparently was more concerned in capturing, maintaining and breeding the exceptional birds for fighting and the more beautiful birds for pets than he was in improving the eating or laying qualities. Breeding for the "fancy" came before breeding for utility. Figs. 1, 2 and 3 show several different types of wild jungle fowl.

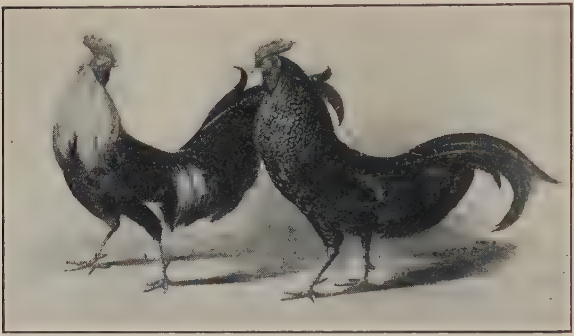

Fig. 1.—Two Species of Wild Jungle Fowl.

The male on the left is of the species Gallus Bankiva and the one on the right Gallus Someratii.

Halpin, of the University of Wisconsin, places chief emphasis upon the factor of competition when comparing the various stages in the evolution of poultry thus: "I believe that the three great steps in poultry keeping were: first, competition—fighting; second, competition—exhibition; third, competition—high egg production."

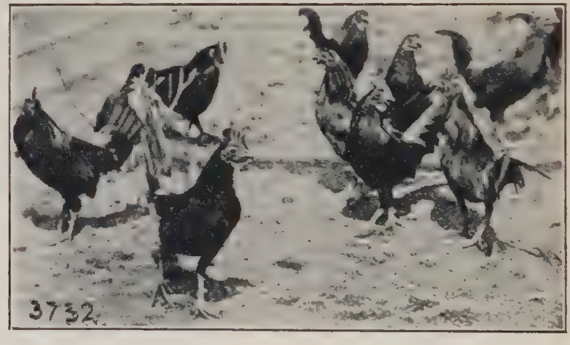

Fig. 2.—The Red Jungle Fowl—the Prototype of Many Breeds of Domestic Chickens.

Note the small size, high rear blade of the combs, shallow bodies, and tail carriage of these birds. All are low producing types, although capable of producing in domestication many more eggs than they normally would lay in the wild state.

We may infer, also, that it was not until man began to traffic in the exchange or sale of poultry and eggs that he fully appreciated the importance of improving poultry for meat and egg laying qualities in order to secure greater profit. Even at the present time this is true to a large extent with many of the so-called ornamental varieties.

The selection of poultry for fighting, domesticity, beauty, meat and egg production all involved keen observation of qualities which could be recognized by the sense of sight. Progress was possible only because these qualities of the birds could be judged by their appearance, by handling them and by their actions. It was on this account that the four first-named objectives were reached far in advance of judging and breeding birds for egg production. The judging for egg production, therefore, is the last and most difficult of the phases of judging to be developed. It must await, of necessity, the discovery of the trapnest before man could learn by individual observation the differences in the physical characters which distinguish birds according to their production quality.

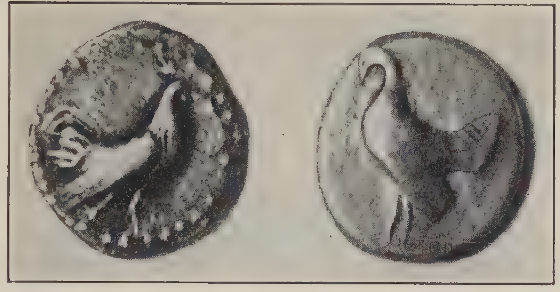

Fig. 3.—Himera Coins, Much Enlarged to Show the Type of Birds

The significance of this picture as well as those in Figs. 1 and 2 is that when our domesticated varieties degenerate due to inbreeding, or crossing, or otherwise, many of the individuals revert to the original types of comb shape, shape of body, flighty disposition, and other characteristics common to the Jungle Fowl.

THE SIGNIFICANCE OF THE TRAPNEST

The discovery and perfection of the trapnest, therefore, was responsible for ushering in an entirely new epoch in the poultry industry and is responsible for the development of an entirely new science and art of judging. Nearly all of this advancement has been brought about within the past forty years and especially during the past twenty years. The discovery and use of the trapnest is, for the most part, responsible for our sensational records in egg production. The advent of the trapnest is, perhaps, the most important single event of the century in the poultry world. Its value is due, not only to the fact of determining the number of eggs laid in any given length of time, but it is responsible for pedigree hatching and progeny testing—the vital requirement in breeding—and it opened the way to the discovery of the whole science and art of judging birds by physical examination, a necessary procedure in all successful breeding operations.

THE DISCOVERY OF PHYSICAL CHARACTERS INDICATING PRODUCTION

Just when or how the discoveries of many of the physical characters were made, or who discovered them, is not accurately known, except possibly in a few instances, and later information may disprove the accuracy of our present knowledge of origin. Here the old adage may be applied that there is " nothing new under the sun." What is thought to be an original discovery by one observer is likely to prove to be but a rediscovery of facts found by others many years before.

An attempt is made here to assemble brief quotations from printed evidence which will show chronologically the progressive steps that have been taken in the evolution of our knowledge of how to judge poultry for production by physical examination. This, of necessity, must be more or less detached and overlapping, and, at best, cannot be even approximately complete.

When Did Culling Begin?—Without attempting to answer the question, but in order to set back the starting date a reasonable length of time, say to 1849, then to the 16th, the 6th and finally to the 1st centuries A.D. respectively, the following statement by Grant M. Curtis is quoted: *

"Some of us may have concluded 'here of late' that culling and selection as applied to the improvement of the domestic fowl are something new or fairly recent in the history of mankind. On the contrary, a few weeks ago we came across an article in the American Agriculturist, Vol. 8, No. 21, month of November, Year 1849, bearing title, 'Rearing and Management of Poultry' (name of author not given) from which the following quotations are made:

Selection of the Cock.

"'Much has been said relative to the selection of the cock; but all, in the end, come to one point. Whatever be the breed to which he belongs, he should exhibit the distinctive characters of that breed in full perfection. He should be bold, lively, clean made, with close, glossy plumage, a high head, short bill and a bright eye; the color of his comb and wattles of a rich, shining vermilion; his crow should be clear, loud, shrill, and long-drawn; his breast, broad and fleshy; his thighs muscular, firm and covered with feathers; his insteps and ankle joints stout; his claws and spurs strong, pointed, and slightly hooked; and lastly, he should carry himself with a proud, yet graceful air, and should be in perfect health.'

WHAT ANCIENTS THOUGHT OF POINTS OF HENS.

"'The good qualities of hens, whether intended for laying or breeding, are of no less importance to be attended to, than those of the cock. To gratify the curious reader, and show what the ancients thought of the points of a hen, we shall give a quaint passage from old Leonard Mascall. Following Columella and Stephanus, he says:

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* Reliable Poultry Journal, August, 1924, Vol. XXXI, No. 6, pp. 596–97.

"'The signs of a good henne are these: To be of a tawnye colour, or of a russet, which are counted the cheefest coloures, and those hennes nexte which hath the pens of their wings blackishe, not all blacke, but parte . . . Their heads ought not to be great, and their tails oughte to be in a meane, and her breast large, and her breast deepe and long, for the greatest hennes of body, are not the aptest hennes to lay, not yet for that purpose so naturale. As for those hennes which have hinder clawes, they will commonly break their eggs in sitting thereon, and they sit not so surely as others, and will ofttimes eat their egges. As for those hennes which doe call or crowe lyke the cocke, or doth creke and scrape to help the same, ye shall pluck off the greatest feathers of her wings and give her millet-wheat to eat.'

"To this we may add, they should be of medium size, of robust constitution, with bright eyes, pendent combs, yellow or bluish legs and feet, and not over four or five years old.'

"Leonard Mascall, an English translator and writer, graced this earth during the sixteenth century, while the Romans whom he quotes or 'follows,' lived in the first and sixth centuries A.D. respectively.

"Undoubtedly in the very nature of things, the culling and selection of domestic fowl is older than is recorded in history. Also it is quite evident that the true history of the domestication of poultry (chickens, geese, ducks, and turkeys) never can be written. Yet doubtless the effort should soon be made to discover and bring down to date many ascertainable facts that unquestionably would be of much value, even in this hustling, work-a-day time, if made easily get-at-able for the knowledge seekers and the wisely studious."

It is truly surprising when reading the above to note the use of so many familiar terms now in everyday use in describing the characteristics of the best and the poorest fowls. The ancient description of the cock from the standpoint of constitutional vigor is almost perfect in the light of our present knowledge.

What the ancients thought of the points of a hen would not be out of place in a modern judging school. Observe that they used the characters, small head, deep and long body, medium size, robust constitution, bright eyes, pendant comb, and cackling and not crowing hens. Constitutional vigor, egg type, laying temperament, and the urge to lay, are all suggested or implied in these characters.

It must therefore be clear that in the elemental characters the domestic fowl has been much the same since the dawn of creation. It is only in the refinements and higher levels of egg and meat qualities that it has changed. Here it has undergone marvelous transformations.

THE FIRST MODERN POULTRY SHOW IN AMERICA, 1866.*

"The Worcester, Mass., Poultry Club held what is believed to be the first show at which poultry was cooped, classed and judged according to previously agreed upon standards and rules, on Thursday, March 18, 1866. The Standard used was that of the English Poultry Club; the method of judging was by comparison; three judges worked together placing the awards. It was the custom to have two or three judges work together at fairs, on all kinds of stock. The object was to prevent awards according to the fads of the judge. It was also held, by judges as well as exhibitors, that two (or more) heads were better than one in judging livestock. No doubt the fact that all judges were amateurs contributed to this feeling."

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* The South Jersey Poultryman of April, 1930.

The Hogan System, 1873

Walter Hogan, author of "The Call of the Hen," was a pioneer discoverer and an aggressive promoter of the value of four particular body measurements as indicating the production value of fowls. These four measurements were the thickness of the pubic bones; the width of the pelvic arch as indicated by the spread of the pubic bones (Fig. 93, Chapter VIII); the span of the abdomen as measured by the distance between the ends of the pubic bones and the rear end of the keel (Fig. 93, Chapter VIII); and the shape of the skull as indicating prepotency.

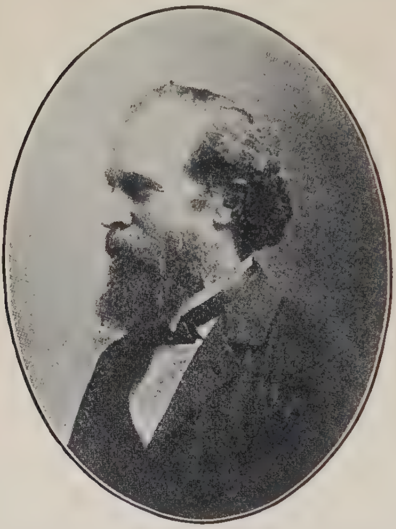

Fig. 4.—Walter Hogan, Deceased.
The originator of the Walter Hogan System.

The "Hogan System" apparently had sufficient truth in it to make it appear plausible and enough of error to make it difficult to apply the system accurately, and therefore it was misleading. Its merit was that the thickness and spread of the pubic bones, as measuring the width of the pelvic arch, form an important character indicating the laying condition of a fowl. It was valuable, therefore, in deciding whether a hen was laying or dormant at the particular time of the observation. Thus it was exceedingly useful in preventing the killing of laying hens. In fact a popular slogan at that time was, "Don't kill the laying hen."

Until comparatively recent times (about 1905) the method of distinguishing a laying pullet from one not laying was largely by making observations as to the general appearance, laying maturity—extent of taking on the characteristics of a laying hen, deeper body, increase in the size and redness of the comb and wattles, increase in appetite, friendliness, singing, cackling, hunting for a nest, seeking the attention of the male, and so forth.

At this time Walter Hogan published (in the *Reliable Poultry Journal*, March, 1905) the description of his discovery of a method of telling a laying hen. His discovery of the variation in the physical condition of the pelvic region of birds increased the number of characters by which birds could be judged for production.

The fact that the measurement of the span between the pubic bones varied widely at different times during the year with the same hen made it misleading—even dangerous when estimating laying capacity—since the same individual when out of production might be condemned as a poor layer and when in production might be selected as a high producer. However, when the system was applied to a flock of birds toward the close of the laying season it was successful in detecting the best layers because these would be the only hens laying late in the fall; they would be the late molting, persistent layers. At the same time the " Hogan System " would be helpful in throwing out the low producers because they would be early molters, out of production, and consequently would have a narrow span between the pubic bones.

On the other hand the breeders who " Hoganized " their birds during the time of the year when all, or most, of the fowls were laying would find it exceedingly difficult, if not impossible, according to the alleged Hogan characters to distinguish between the best and the poorest producers since all, when laying normally, would be expected to have flexible pubic bones set wide apart.

The variation in the flexibility and spread of the pubic bones in the same bird is based upon a natural physiological law, applicable to all vertebrate animals, namely, that in all mammals (those that suckle their young) or in egg-laying animals when in active production the body undergoes radical changes by which the bony framework softens, and the joints loosen and the muscles relax. The body takes on fat and stores up every nutrient necessary for the support of the parent and provides for the production of perfect eggs and later the development of the embryos.

Conversely, when the mammal is no longer pregnant, or the bird is no longer productive, but each is dormant so far as the reproductive function is concerned, the body resumes its normal state. In case of the fowl, when out of production the pubic bones harden and draw together and frequently become thick with hard fat, and the vent is contracted in size. Other parts of the body, particularly the comb and wattles, the abdomen and the finger bones undergo similar changes due to the activity or inactivity of the reproductive system.

The discussion of the physical condition of birds as influencing the use of the " Hogan factor " of the width of the pelvic arch and pubic bones will serve to explain why his second factor, the depth or span between the end of the pubic bones and the rear end of the keel, is not entirely a dependable factor when taken singly or in connection with the width of the pelvic arch.

A study of the body changes which take place when fowls pass into and out of production shows that there is a large expansion of the interior cavity of the body when the fowl comes into production and reduction when the same bird goes out of production. This is due to the great increase in the size of the reproductive organs, the ovary and oviduct, and of the supporting digestive and circulatory systems. This increase has been shown to be as high as 900 per cent in the reproduction system alone. (Hall, 1926.) Such an increase in size and weight of the internal organs is made possible by the loosening of the joints, spread of the ribs, and drop of the keel. The last of these is responsible for a marked increase in the depth of the abdomen. (Fig. 93, Chapter VIII.) This in turn greatly lengthens the span between the ends of the pubic bones and the rear end of the keel. Thus a bird out of production might have a span of only two fingers and the same bird when in full production might have a span of three or four fingers. Hence the two Hogan factors have similar limitations.

Another weakness of these two Hogan factors is the fact that, irrespective of the width of the pelvic arch, the length of the pubic bones may vary as between individuals of similar production and laying condition; and the same is true regarding the length of the keel. It will be readily seen, therefore, that a short or long keel or short or long pubic bones might be responsible for determining whether the span between the end of the keel and the pubic bones was two, three or four fingers.

From this discussion it would appear that Walter Hogan deserves much credit for his contribution in helping to determine by two variable physical factors whether or not a pullet or a hen is or is not laying, but that these two factors are not reliable in the judging of a bird's production value except at times when only the better ones would be laying, which in the case of hens would be at the end of their laying year and pullets of the same age and breed coming early or late into production.

Walter Hogan, like many another lover of poultry, was a keen observer. Unlike many another he " followed the lead " and worked out a system, or philosophy of judging, based upon a few characters. He apparently overlooked or lost sight of other characters which he could have used to good advantage in checking against his system.

His apparent failure to do this prevented the most accurate application of the Hogan System. Notwithstanding the limitations to the successful application of the Hogan System, to Walter Hogan goes the credit of causing thousands of persons to think in terms of differences in the handling quality of hens as indicating their laying condition. Any person who has a good idea and is responsible for stimulating further observation and investigation in the same or similar direction, is to that extent a public benefactor. Walter Hogan did this.

THE MOLTING AND PIGMENT CHARACTERS, 1876.

Kent (1916) states that he had found an article published in 1876 in the *Cultivator* and *The Country Gentleman*, written by a woman contributor. This woman reported that "late layers were late molters and that late molters molt rapidly."

Kent quoted the following statements from another article written by the same author and published in the same periodical in 1879.

> "Towards fall there comes a change over the birds. Their plumage grows rusty, and the bright orange legs fade out as the season advances for the second molt. Especially is this true of persistent layers. Often and again have I been disappointed in my fine yellow legged birds of early spring, for, as the season advances, and they pile the eggs up, the legs gradually bleach out until they become, by August, a pale flesh or, as generally termed, white. The bloom is washed off, and in a Leghorn is almost a certain indication of a good layer.
>
> "In Leghorns, either Brown or White, the whitest earlobed bird is apt to possess the palest colored legs—often a pale lemon that fades to flesh color. The deep orange tint will fade with egg production."

How many thousands of men and women have looked at the same characters before without seeing them with the eyes of understanding? Here are statements regarding two important characters expressed clearly, concisely and accurately more than fifty years ago.

These quotations indicate the value of original observation and the length of time important facts may be known before they are fully appreciated and generally adopted. Even now, after all that has been written, spoken and practiced, there are many who do not understand or believe the many valuable facts which are or have been practiced by others for many years.

C. H. WYCKOFF, A PIONEER PRODUCTION BREEDER, 1885

The late C. H. Wyckoff was a pioneer breeder of Single Comb White Leghorns of world-wide reputation. He was one of the earliest exponents of selecting birds for production by physical examination. He, more than any other breeder, laid the foundation for production quality of White Leghorns in the United States in the period preceding the invention of the trapnest. It was at this time that his greatest influence was felt and it has not ceased.

FIG. 5.—C. H. Wyckoff, Deceased.
A Pioneer Production Breeder.

The following early descriptions of characters which were thought by various observers to indicate production qualities are significant.

By C. H. Wyckoff, 1891.

Body Type.—"Large boned, rather long in leg and neck; long on the back, deep up and down behind, with legs set well apart; breast bone somewhat prominent; flesh hard, strong and muscular; in good condition, but not too fat."

Head Type.—"Comb rather above the average in size; eyes bright and full."

Temperament. —"Disposition lively, but not too scary; more inclined to follow after and crowd about the attendant than to run and fly at his approach."

Appetite.—"Large consumers of food and always hungry when fed regularly and given a chance to exercise."

J. D. Tompkins, 1891.

Body Type.—"Broad, deep, round body of moderate length and not too chunky."

C. A. Sharpe & Co., 1891.

Body Type.—"A squarely built, blocky, well proportioned hen, wide on the back, and with legs well apart, will produce the most eggs. The legs and neck should be of medium length."

Refinement.—"The finer the texture of the face the more eggs will be produced."

H. S. Babcock, 1891.

Size and Activity.—"I find that a hen of rather light build, indicative of great activity, and of medium or perhaps rather under medium size for the breed is usually the best layer."

Body and Head Type.—"A hen with short legs, chunky body, and small head is not the best type for a prolific layer."

F. B. Zimmer.

Temperament.—"But for her actions as a pullet, when nearly matured, one can almost always say with a fair degree of accuracy that the bright, active, nervous, mischievous specimens are the best producers."

E. B. Thompson.

Head and Body Type.—"I think the shape of the head or body has nothing to do with egg production. Hens with large combs, however, are usually the best layers."

J. H. Drevenstedt.

Refinement.—"The reason why shape cannot well determine the egg laying trait is because birds are covered with feathers which may completely hide the egg type. I would always prefer a fine boned hen to a coarse boned one."

Ida E. Tillson, 1895.

Body Type.—"The laying hen should have rather short legs, but good length of body, and be wide across the shoulders and back."

Temperament.—"She should not be fat and lazy, but trim and active." "Like people of the same build, she is full of life and vigor. She is an active scratcher and a good singer."

Close Feathered.—"The laying hen is one that disappoints you in weight; that is, she weighs more than you would suppose from her appearance."

William Cook, 1895.

"Where fowls are kept for laying principally it would be an easy matter to detect the best laying hens, as these are sharp-looking, intelligent birds, with bright eyes, and a nice sleek-looking head, and are usually out first in the morning and go to roost last at night. If my readers will refer to the engravings of heads given (Fig. 6), they will see at a glance the difference in appearance of the eyes and head generally of the two birds."

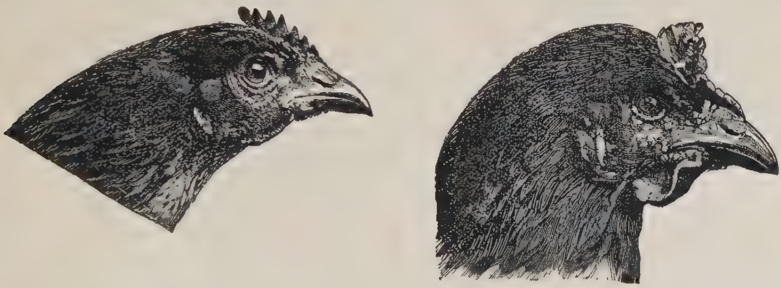

Fig. 6.—A Very Early Classification of Head Types, Reproduced from William Cook's "Poultry Breeder and Feeder," 1895.

The head on the left is a high-producing type whereas the one on the right is a low-producing type.

A. F. Hunter, 1896.

Molting.—"Fowls in high condition and well fed molt more easily and more quickly than others, and young (one year old) fowls molt more easily, and earlier, than two, three or four year old fowls. As a rule, the older a fowl gets, the harder and later will she molt. By selecting hens that molt easily and quickly to breed from, the habit can no doubt be transmitted to the progeny."

C. H. Wyckoff, 1896.

Rate of Molting.—"I have had hens that lay to some extent nearly through the molting period; but they usually stop for a time when the new feathers are making the most growth. I do not believe that there is any practical method of hastening or shortening the molting period of hens, except to care for them at all times, that they are kept in that bright, active, happy and comfortable condition commonly seen only in the spring and early summer. I notice that there is great difference in hens about their molting; some molt very gradually, dropping a few feathers at a time, and having many new feathers full grown before all of the old ones are dropped. These hens will lay some while molting, but do not finish the molt nearly so quickly as those which shed the old coat all off in a few days' time. I do not feel sure that either one is the more desirable than the other, but am inclined to favor the one that molts quickly."

James H. Seeley, 1896.

Age and Molting.—"A yearling hen will always molt earlier than a two or three year old hen. I do not think that early molting could be made hereditary; it is in the condition of the fowls more than anything else. I have had hens lay all through their molting, but I think that it is just as well for them to rest through that period."

JUDGING FOR PRODUCTION BY PHYSICAL EXAMINATION *—1900, 1901

"There are certain 'hen characteristics' that a person who will care for his fowls well enough to make them a success certainly will recognize, so that he can pick out, with a great degree of accuracy, the best fowls in his flock. I know that this is true, because out of six hundred Leghorn hens, we have selected four hundred and fifty for breeding purposes, and one hundred and fifty have been rejected. They were picked out gradually from the time they were shut up last fall, the first of November, one or two a day, as they were discovered. The difference in egg yield of these two classes of hens was very marked."

CULLING THE FLOCK FOR EFFICIENT PRODUCTION

"This means that you can pick out a flock of the best hens by their egg type and feed them by themselves, and also pick out another flock of the same number, but not of the 'egg type,' and you will receive twice the egg production from the one that you do from the other. This is something that is within the reach of all."

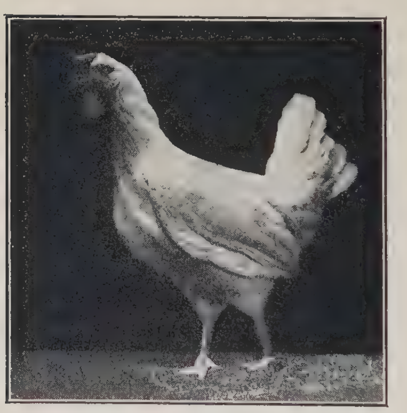

FIG. 7.—A Precocious Pullet—Selected in the Fall of 1897 to Illustrate the Principle of Early Laying Maturity as a Sign of High Production.

The first egg was laid at 4 months and 24 days of age. Weight of the second egg was 1½ oz. and the weight of the pullet was 3½ lb. Size of bird, quality of the egg, and precocity were emphasized by the senior author.

FLOCK SEGREGATION FOR EFFICIENT MANAGEMENT

Pullets of the Same Age that are the First to Lay are the Best

"The easiest time to select the best laying hen (pullet) is when fowls of the same age are together. The pullets that lay first are almost always the best producers. (Fig. 7.) This is because they have inherited the tendency to lay."

How to Pick the Best Producers by "Egg Type"

"In order to illustrate the 'egg type' to those who might never have given it a thought, I have photographed a few pullets that represent those characteristics." (Fig. 8*a*:) [This shows a group of White Leghorn pullets selected and photographed in the fall of 1897 by the senior author to represent his idea of the production type of the "business hen." The photograph was used for many years in Farmers Institute work and at the first one week poultry schools in New York State in the form of a "bromide enlargement." Among those taking part in these meetings were T. F. McGrew, Dr. E. M. Sante and Mrs. Mary Monroe. The characteristics then used in judging poultry for production were precocity (early laying maturity), size of body, egg type and egg quality. Hens were picked for constitutional vigor, size of comb and "wedge shape" of body as viewed from above, side or rear. The similarity between these birds and those selected now for high egg production is very striking. The only material difference in appearance between the birds selected then and now is in the tail carriage. Fashion has decreed a more graceful curve of the back and tail in the modern Leghorn.]

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* Quoted from a stenographic report of a lecture by the senior author, "Annual Report New Jersey State Board of Agriculture," 1900–1901.

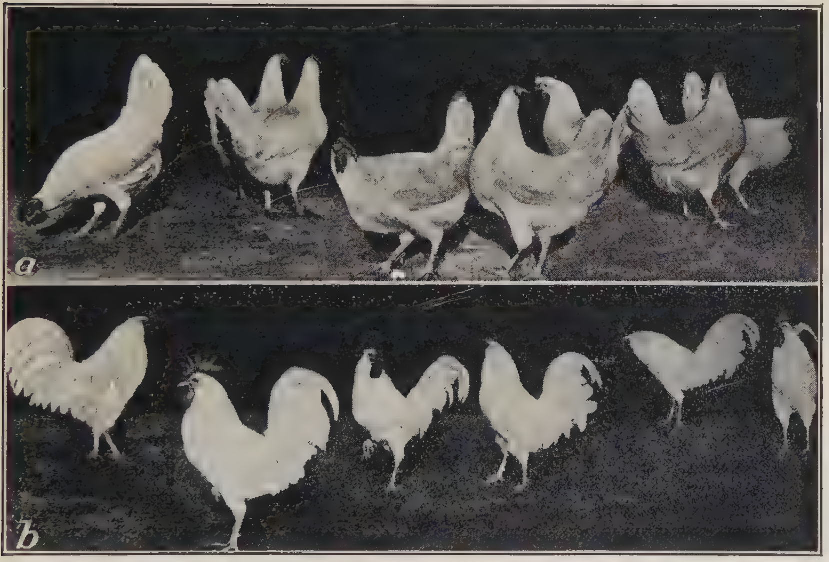


FIG. 8.—True Egg-type Leghorns as Selected in 1897.

a. Pullets hatched in the latter part of February; laid first eggs latter part of July. Picture taken in October when they were beginning to show the form which is characteristic of the best layers. Note the length of body and the depth from the saddle to the keel; also the pronounced development of the fluff and the large combs.

b. Observe the large size, the long, deep body, large comb and beauty of outline. In life you would note their vigor and gallantry. Egg-form is as important in males as in females.

"Let us understand, however, that shape alone does not mean 'egg type' any more than the conformation of a dairy cow alone means 'milk type.' This is for the simple reason that there are individuals which will inherit a perfect form, but do not have the constitutional vitality behind them to sustain and carry them through high egg production. A good laying hen should lay five times her own weight of eggs in a year. This requires a tremendous constitution and capacity to digest food, and to manufacture it into a concentrated product, the egg."

CONSTITUTIONAL VIGOR MOST IMPORTANT

"Therefore, I believe that the first thing we should do in selecting our fowls for egg type is to get constitutional vigor. Many a fowl and many an animal that is deficient in function and in type will overcome the handicap by virtue of having a tremendous power to digest food, and having a splendid constitution. We cannot afford to breed from weakened vitality."

THE SHAPE OF THE EGG-TYPE HEN

"You will notice that these Leghorns, Fig. 8*a*, are large rangy fowls. They would weigh four and one-half pounds easily when that picture was taken in the month of November. Notice how long they are from the front of their necks right down through their backs in a straight line to the tail. And you will notice how extremely deep they are from a point on the saddle right down through to the keel underneath, and with a large fluff."

CORRELATION BETWEEN THE REPRODUCTIVE ORGANS AND SECONDARY SEXUAL CHARACTERS, THE COMB AND WATTLES

"By studying the fowls internally you will find that there is a certain correlation of parts. And you can generally depend upon it that within the breed itself, the ones that have the *largest combs* usually have the *largest internal development of the egg laying function* (organs). With those small shriveled-up effeminate combs you do not get the vigor and you do not get the internal development.

"Therefore, in selecting fowls you must have: first, constitutional vigor; second, shape of the fowl itself; and third, to try and determine the egg function within by the size of the comb and general intelligence."

NERVOUS ENERGY AND BRAINS NECESSARY FOR HIGH PRODUCTION

"You will never get high individual quality and production without splendid development of *nerve force*. That means intelligence."

FRIENDLINESS A SIGN OF INTELLIGENCE AND PRODUCTION

"The best egg producers are the ones that have the most intelligence. When you come to the hen house they know you, and come around you and fly onto your shoulder. All these qualities harmoniously blended together make the perfect egg type."

THE BEST LAYERS HAVE BEST DEVELOPED OVARIES

"If you were to make an examination of each of these pullets (Fig. 8*a*) you would discover that the birds which naturally lay first are your largest egg producers. They will have the cluster of developing eggs attached to the backbone excessively developed, and conversely all the pullets that have never laid many eggs and never can lay many, will have only a very small development of the ovary."

CONSTITUTIONAL VIGOR AND LONGEVITY A VITAL FACTOR IN AGE AND SUSTAINED PRODUCTION

"The capacity of a good hen to lay eggs is only limited by the strength of her constitution to withstand the drain upon her system. I once owned two Brown Leghorn hens. One laid very nicely through the winter. Not as much as a pullet, but she laid a good many eggs, and when she died and I examined her ovaries, I could see little eggs developing, some of them not larger than a pinhead. She had a won-

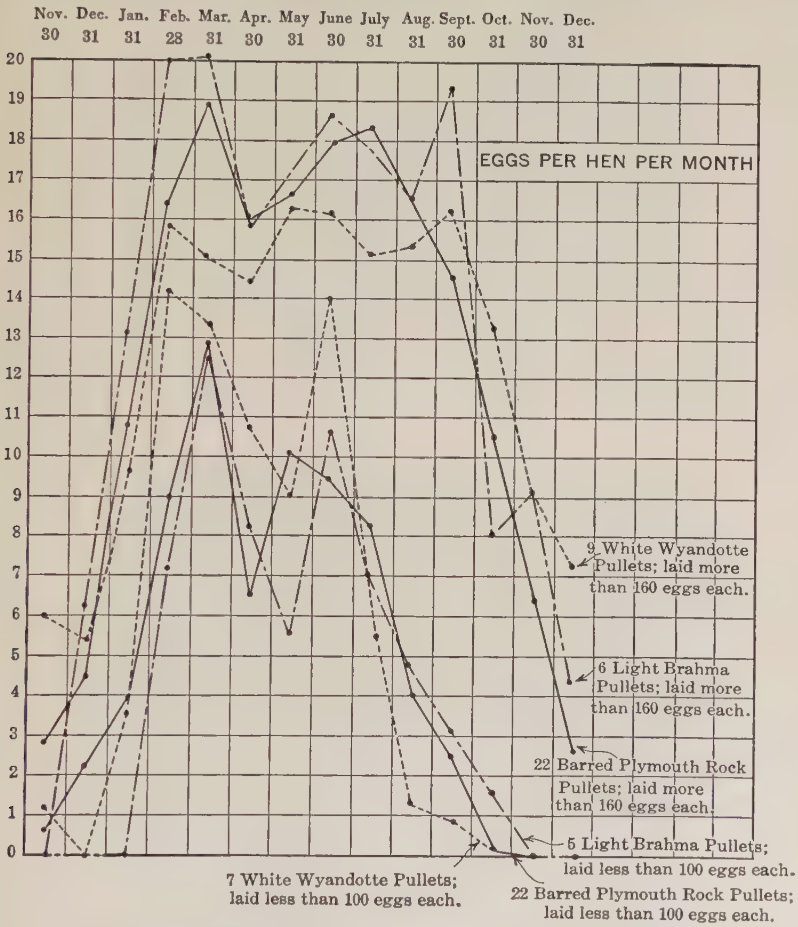


FIG. 9.—Monthly Distribution of Egg Production of Three Breeds of Poultry: (1) White Wyandottes, (2) Barred Plymouth Rocks, (3) Light Brahmas.

The three top lines plot the average production of the highest birds in the flock and the three lower lines show the average production of the lowest birds in the flocks. It was pointed out that the highest producers (1) laid youngest, that is, were more precocious; (2) laid longest—were more persistent; and (3) had the longest laying period. These data were from the first official trapnest records available. Maine Agr. Exp. Station, Prof. Gowell. Graphs by the senior author. Quoted from lecture printed in the Annual Report of the New Jersey State Board of Agriculture, 1900–1901.

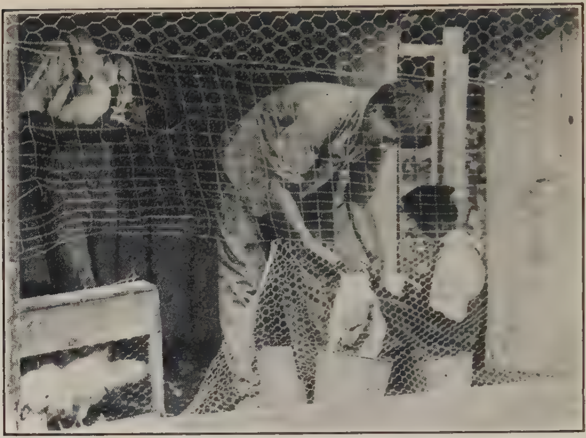


FIG. 10.—Miss Clara Nixon and Helpers Dipping Hens and Pullets in Different Colored Dyes for Individual Detailed, Molting Observations.

Observations were taken from August 11, 1906, to January 26, 1927, on 232 birds. Orange, violet, carmine and green were the most enduring colors.

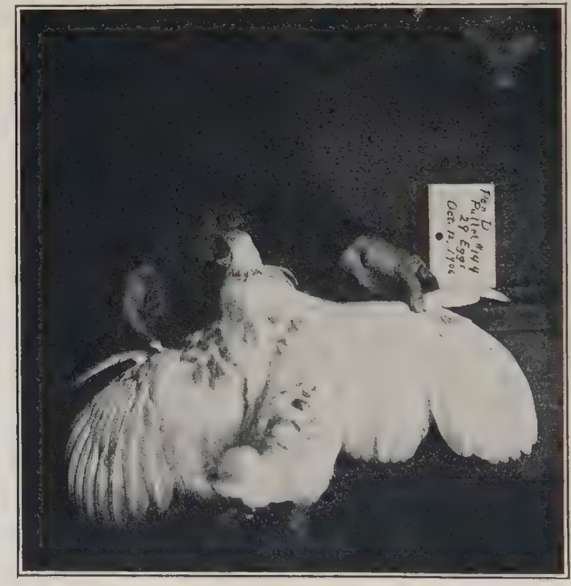


FIG. 11.—Clara Nixon Holding a Dyed White Leghorn Pullet Used in Studying the Molt as a Factor in Judging Poultry for Production.

Here the principle of the sequence in shedding feathers was definitely established, and described in Cornell University Experiment Station Bulletin 258. Note the characteristic pullet neck molt.

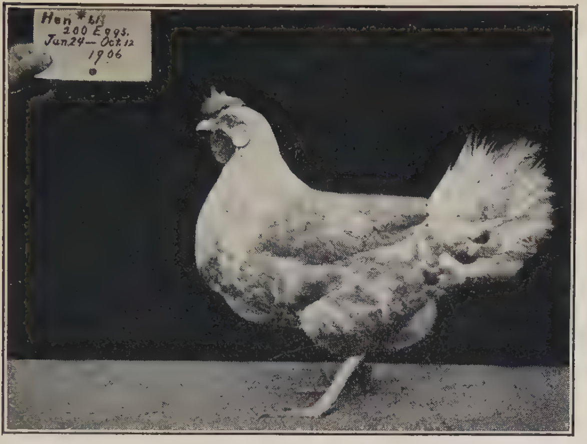


Fig. 12.—Hen No. 61, in Full Laying Condition and Not Molting, October 12, 1906.

Her record was 213 eggs in 261 days, January 24 to October 12, 1906. She was the best laying hen in the experiment and the last to molt. She shows some neck molt as indicated by the new white feathers as contrasted with the old dyed feathers.

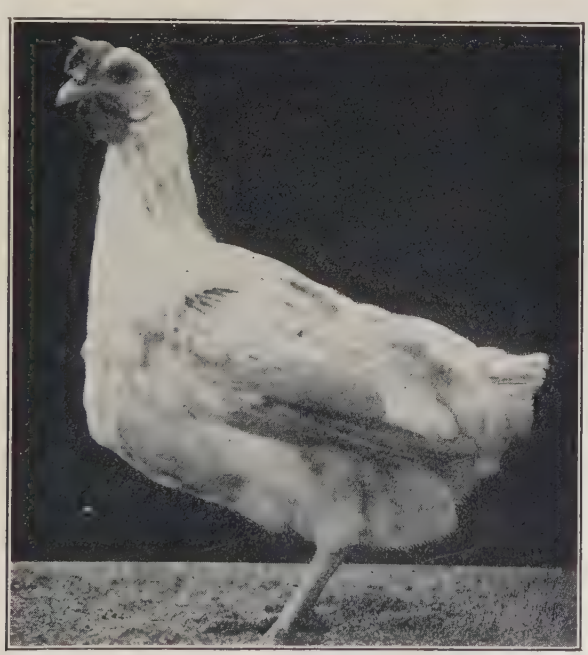


Fig. 13.—Hen No. 61, in Heavy Molt, November 26, 1906.

This is the same hen as in Fig. 12. Observe the old primary and secondary wing feathers still not dropped, while the new body and tail feathers are partially developed and the neck feathers well grown.

derful constitution, and a large development of the ovary, and the only limit to her producing eggs was the strength of her constitution to digest the required food."

Fig. 8*b* is also reproduced from the annual report of the New Jersey State Board of Agriculture, 1900–1901. The photograph was taken in the fall of 1897 by the senior author to show the characteristics of the "egg type" Leghorn male of that day. With the exception of higher tail carriage, smaller size, and shallower bodies, these Leghorns of 33 years ago resemble the production bred Leghorns of to-day. Modern Leghorns in order to meet the demands of higher production and larger eggs are becoming larger boned and deeper bodied. They are built for heavy duty.

EARLY INVESTIGATIONAL WORK IN MOLTING, 1908

Among the early extensive investigations to secure facts and to establish principles governing the physical changes in fowls which bore important results were the molting experiments at Cornell University. These investigations were undertaken by Nixon, Rogers, and Conger in order to determine the sequence of feathering and molting and the influence of several environmental, age and production factors on the

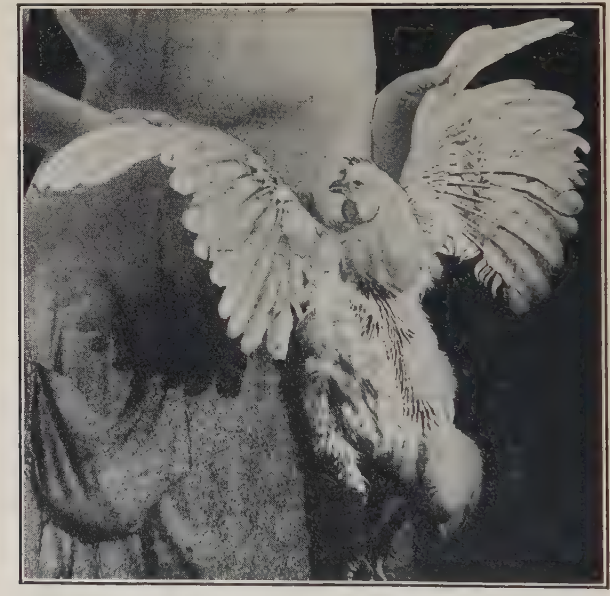


Fig. 14.—A Study in Molting as an Indication of Production.

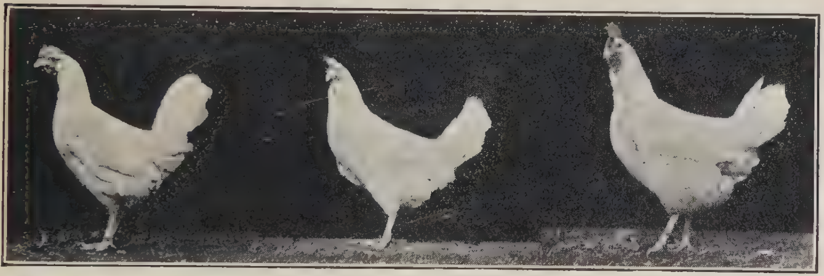
This bird gave Miss Nixon the key to the principle that late shedding and rapid molting are an indication of persistency in production. (Molting experiments, Cornell University, 1906.)

time of molt and recovery from molt. The results were published in Bulletin 258, entitled "The Molting of Fowls."

Among the important results of these observations was the rediscovery by scientific proof, of the principle that the "best layers molt last," and that the "early molters lay least." Figs. 10, 11, 12, 13, and 14 show several birds used in the molting experiments and the interesting technique developed in taking observations.

EARLY "LONG-DISTANCE" LAYERS, 1912

The three long-distance layers in Fig. 15 are used to illustrate progress in breeding as a direct result of trapnesting. The production of 665, 648 and 539 eggs per bird, respectively, in three years seemed a large number of eggs, and it was a large number, November 1, 1912, when the photographs of these three birds were taken. The march of progress in breed improvement is also well shown in the three distinguished examples of prolificacy, vitality and longevity. These birds inherited the urge to lay in quite different types and sizes of bodies, and also had very different types of heads and tail carriage. They differ, also, somewhat in temperament. These differences, it should be understood, do not disprove the importance of each of the characters mentioned in the judging of birds for production. They do indicate, however, that no one character can be depended upon to prove to what extent a hen has inherited the urge to lay.



First: "Cornell Supreme" (3418), weight 3.48 lb. Eggs laid: 1st year, 242; 2nd year, 198; 3rd year, 225. Total 3 years, 665.

Second: "Lady Cornell" (3211), weight 3.58 lb. Eggs laid: 1st year, 257; 2nd year, 200; 3rd year, 191. Total 3 years, 648.

Third: "Madam Cornell" (9363), weight 4.16 lb. Eggs laid: 1st year, 245; 2nd year, 131; 3rd year, 163. Total 3 years, 539.

Fig. 15.—Early Examples of Long Distance Egg Production.

The three birds differ in size and type but are similar in vitality, the urge to lay and longevity. Photographs taken November 1, 1912, at the end of the third laying year.

A further examination of the three birds at the time the photographs were taken would have demonstrated, unmistakably, that they were exceptionally high producers. The absence of molt, the light color of the beak and shanks, the fullness, fine texture and red color of comb, the size, shape and color of the vent, the pliability of the abdomen, the spread and flexibility of the pubic bones, the alert expression and fire of the eye and many other less important characters would have enabled any well-informed production judge to select these birds from among a flock of low or medium individuals as outstanding birds.

It is of very great historical interest that scarcely a decade before these three birds were discovered by the use of the trapnest (one hardly could claim that they were the result of scientific breeding), poultry breeders and judges would have looked upon these birds with blank minds so far as comprehending their real value was concerned, as compared to others which they might have seen in the showroom.

All of these advancements in human knowledge teach the fundamental truth that breeders must understand the causes as well as the effects back of the fixed and variable physical characters as indicating the bird's value as a producer and a breeder. The modern poultryman understands that production beauty is more than skin deep. Beauty is important for beauty's sake but it cannot be a substitute for production value.

It should now be clear that our modern knowledge of selecting birds by physical examination, with regard to production values, no longer justifies the practice of judging them solely with regard to their health and breed and varietal characteristics. We can make progress in breeding only as we make advancement in selection. The day is at hand when all judges, in order to have the proper qualifications, must be proficient alike in the knowledge of both production and standard values.

EARLY EFFORTS TO PRESENT THE FACTS CONCERNING PHYSICAL CHARACTERS, 1913, 1914 TO 1917

Fig. 16 illustrates one of the early efforts to teach the judging of hens for egg production by physical characters, known as the *index method*. Here four characters were used: (1) the comb texture; (2) shank color; (3) earlobe color, and (4) molting condition. Each character was given numerical values from 1 to 5 points. A rating of 1, 2, 3, 4 or 5 indicated high, medium, low or lowest respectively. [In order to compare this early method with our present knowledge one should study the descriptive terms defining the degrees of quality of each of the four sections, comb, shanks, earlobes and molt. Then, if possible, take trapnested birds, hens or pullets, showing the contrasting types and grades of production and see how closely the physical character ratings agree with the production of the birds. Birds kept under similar conditions of management should be used.]

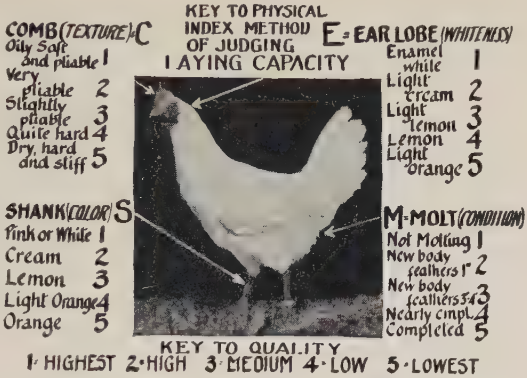

KEY TO PHYSICAL INDEX METHOD OF JUDGING LAYING CAPACITY
COMB (TEXTURE) = C
Oily Soft and pliable 1
Very pliable 2
Slightly pliable 3
Quite hard 4
Dry, hard and stiff 5
E = EAR LOBE (WHITENESS)
Enamel white 1
Light cream 2
Light lemon 3
Lemon 4
Light orange 5
SHANK (COLOR) S
Pink or White 1
Cream 2
Lemon 3
Light Orange 4
Orange 5
M = MOLT (CONDITION)
Not Molting 1
New body feathers 1st 2
New body feathers 3-4 3
Nearly cmpl. 4
Completed 5
KEY TO QUALITY
1 = HIGHEST 2 = HIGH 3 = MEDIUM 4 = LOW 5 = LOWEST

Fig. 16.—The Index Method of Judging Fowls for Egg Production.

One of the earliest methods used at Cornell University. 1913.

More accurate systems of judging, involving more characters and different valuations for each character, have been developed since this plan was first formulated in 1913. The hen shown in Fig. 16 is "Lady Cornell," the first 200-egg hen produced, or rather discovered at Cornell University. She rated one in each section; comb soft and pliable; shank color white; earlobe enamel white; molt, not molting in any section. Observations were made in late fall when she was still laying.

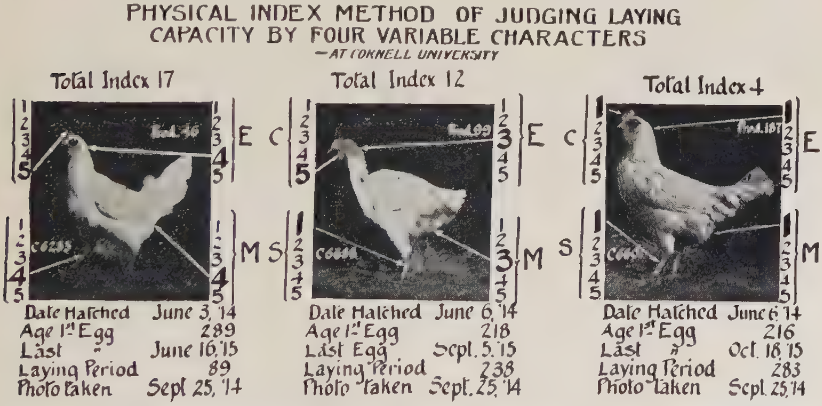

PHYSICAL INDEX METHOD OF JUDGING LAYING CAPACITY BY FOUR VARIABLE CHARACTERS
—AT CORNELL UNIVERSITY
Total Index 17
Ind. 46
C6235
C
E
S
M
1 2 3 4 5
Date Hatched June 3, '14
Age 1st Egg 289
Last " June 16, '15
Laying Period 89
Photo taken Sept 25, '14
Total Index 12
Ind. 99
C6604
Date Hatched June 6, '14
Age 1st Egg 218
Last Egg Sept. 5, '15
Laying Period 238
Photo taken Sept. 25, '14
Total Index 4
Ind. 187
Date Hatched June 6, '14
Age 1st Egg 216
Last " Oct. 18, '15
Laying Period 283
Photo taken Sept. 25, '14

Fig. 17.—The Index Method of Judging Laying Capacity by Four Variable Characters: (1) Comb, (2) Earlobe, (3) Shank, (4) Molt, and also by the Factors Precocity, Persistency, and Length of the Laying Period.

Fig. 17 shows a triple contrast in the physical characters of hens varying in production from 46, 99 and 187 eggs respectively as seen from left to right. The photograph was taken September 25, 1914. Here the factors of precocity, persistency, and length of the laying period were used in addition to the physical index of four variable physical characters as shown in Fig. 16. This is reproduced from a chart used in 1914 for teaching and educational exhibits. By the index method of judging, the three hens were rated as shown in the illustrations, 17, 12, and 4 respectively. Their value is in the inverse order to the size of the score.

The three factors, precocity, persistency and length of the laying period, agree with the index valuations as shown by the difference in the age of laying first egg (precocity), 289, 218 and 216 days respectively for the low, medium and highest producer. The length of the laying period of the birds in the same order was 89, 238 and 283 days as expected. The dates of laying the last eggs as indicating their persistency was June 16, Sept. 5, and Oct. 18, respectively. Here again the birds ran true to form. These birds were selected to illustrate these principles.

A careful examination, section by section, of the birds and their physical index ratings shown in the illustrations will reveal that in all characters—head points, molting condition, pigmentation, body type, condition, etc.—they are typical for low, medium and high producing birds. The contrasts in physical condition would have been more marked if the photographs had been taken in October.

In Fig. 18 is shown a marked contrast in the appearance and laying quality of hens. This is indicated by differences in four characters compared on a numerical basis. (See upper right-hand corner of each picture.) These are comb, shanks, molt and earlobes. Each one has the same maximum value of 1 point and minimum value of 5 points, the smallest to the largest numerical values representing the various degrees of pigment, molt, etc., and indicates highest to lowest production.

Although the premise that the proper values were given to the four characters is not wholly accurate, it is certain, nevertheless, that although the method of estimating the score could be improved, due to our more complete knowledge at the present time, the method here shown is quite effective.

Note the contrast in types between the two rows of hens on the right and the two rows on the left. The six best producers score 7, 11, 8, 14, 13 and 12, a total of 65 points or an average of 10.8, whereas the poor producers were rated 15, 16, 16, 16, 14 and 15, or a total of 92, or an average of 15.3. The average age to laying of first egg was 204 days for the best producers as against 276 days for the poor producers. The average length of the laying period was 312 as against 150 days respectively. All of the six hens on the right, although having longevity values, laying a few eggs for four to six years, should have been discarded as culls and all of the other six hens on the left could have been retained as breeders because of their longevity and medium high production. The error here was in using two pigment characters, shanks and earlobes, each of which have different lengths of time in which the pigment disappears, the shanks holding the pigment much longer than the earlobes.

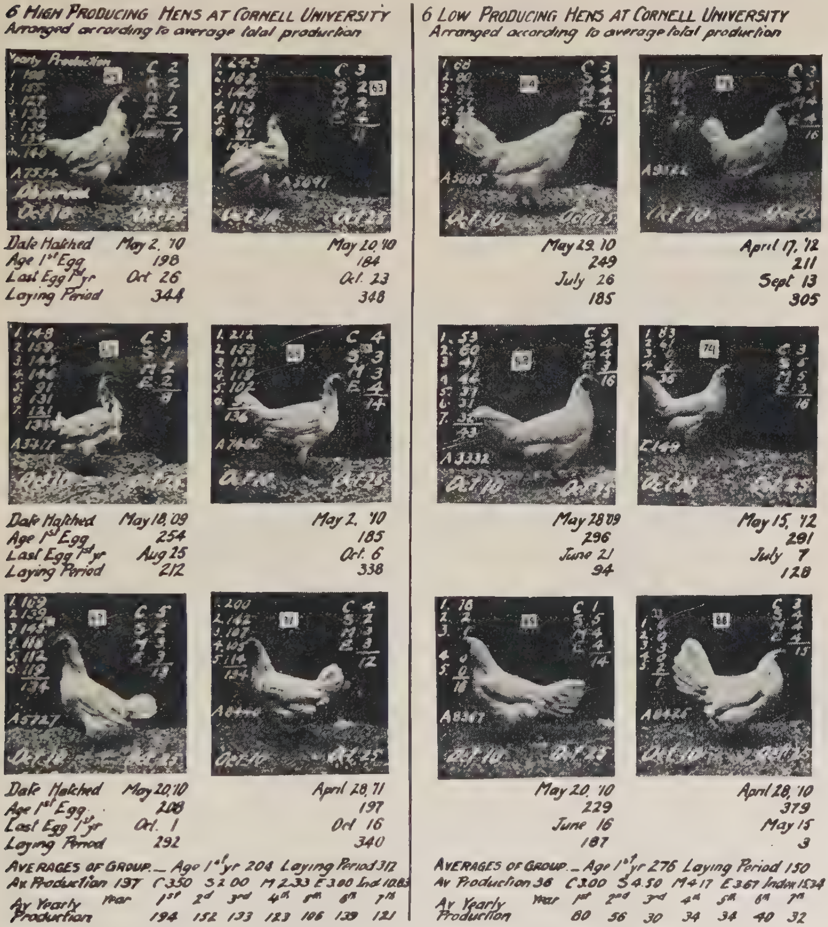

6 HIGH PRODUCING HENS AT CORNELL UNIVERSITY
Arranged according to average total production
6 LOW PRODUCING HENS AT CORNELL UNIVERSITY
Arranged according to average total production
Yearly Production
A7534
A5097
A5085
Date Hatched May 2, '10
Age 1st Egg 198
Last Egg 1st yr Oct 26
Laying Period 344
May 20, '10
184
Oct. 23
348
May 29, '10
249
July 26
185
April 17, '12
211
Sept 13
305
A3411
A3332
E149
74
Date Hatched May 18, '09
Age 1st Egg 254
Last Egg 1st yr Aug 25
Laying Period 212
May 2, '10
185
Oct. 6
338
May 28 '09
296
June 21
94
May 15, '12
281
July 7
128
A5727
A8367
A8425
Date Hatched May 20, '10
Age 1st Egg 208
Last Egg 1st yr Oct. 1
Laying Period 292
April 28, '11
197
Oct 16
340
May 20, '10
229
June 16
187
April 28, '10
379
May 15
3
AVERAGES OF GROUP.— Age 1st yr 204 Laying Period 312
Av Production 137 C 3.50 S 2.00 M 2.33 E 3.00 Ind 10.83
Av Yearly Production Year 1st 2d 3rd 4th 5th 6th 7th
194 152 133 123 106 139 121
AVERAGES OF GROUP.— Age 1st yr 276 Laying Period 150
Av Production 36 C 3.00 S 4.50 M 4.17 E 3.67 Index 15.34
Av Yearly Production Year 1st 2nd 3rd 4th 5th 6th 7th
80 56 30 34 34 40 32

FIG. 18.—An Attempt to Express Mathematically the Laying Values of Hens Based on a Comparison of the Combs, Shanks, Molting Conditions and Earlobes.

In Fig. 19 are shown the photographs of two hens differing by 167 eggs per year in their production, contrasted for use in Extension teaching, at Cornell University, in 1917. The principal variable, physical characters used for comparison were those representing the condition of the abdomen, pigmentation, earlobes, face, beak and shanks, the comb color and texture, plumage condition and time of molting. Although not shown in the illustration the characters of body type and head type were emphasized.

In this manner, little by little, the poultrymen and poultrywomen and the college investigators have added to the sum total of knowledge of the characters which may be used in judging poultry for production.

The colleges and independent writers were quick to respond to the demand for information on culling and selecting. From 1905 to 1918 there appeared many useful research and Extension publications, some of the more important of which are referred to in the Bibliography.

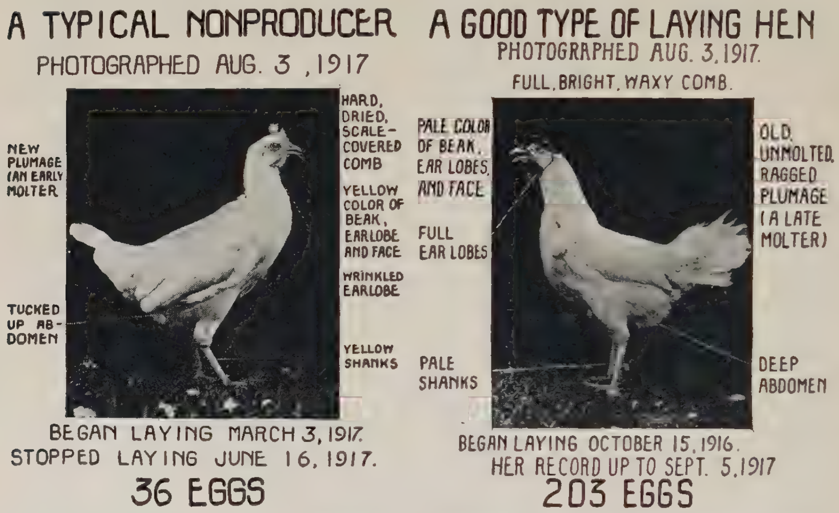

A TYPICAL NONPRODUCER
PHOTOGRAPHED AUG. 3 ,1917
NEW PLUMAGE (AN EARLY MOLTER
TUCKED UP AB-DOMEN
HARD, DRIED, SCALE-COVERED COMB
YELLOW COLOR OF BEAK, EARLOBE AND FACE
WRINKLED EARLOBE
YELLOW SHANKS
BEGAN LAYING MARCH 3, 1917.
STOPPED LAYING JUNE 16, 1917.
36 EGGS
A GOOD TYPE OF LAYING HEN
PHOTOGRAPHED AUG. 3, 1917.
FULL, BRIGHT, WAXY COMB.
PALE COLOR OF BEAK, EAR LOBES, AND FACE
FULL EAR LOBES
PALE SHANKS
OLD, UNMOLTED, RAGGED PLUMAGE (A LATE MOLTER)
DEEP ABDOMEN
BEGAN LAYING OCTOBER 15, 1916.
HER RECORD UP TO SEPT. 5, 1917
203 EGGS

Fig. 19.—Early Efforts to Compare Contrasting Characters of Hens Differing Widely in Physical Characteristics—Cornell University, 1917.

By 1918 the demand for specific instruction in the judging of poultry for production resulted in the establishment of a poultry judging school at Cornell University. Here many of the best known authorities brought together and compared the latest ideas and put them into practical application in the class room. This occasion became the melting pot where new ideas were tried and adopted or rejected. Each year a committee of instructors formulated a brief statement embodying the latest accepted views of the relative significance of the characters used in production judging. By comparing the first report of 1918 and the one made ten years later one may note the progress made in this field.

A METHOD OF JUDGING FOWLS FOR EGG PRODUCTION, 1918

(As formulated at the Judging School held at Cornell University, Ithaca, N. Y., July 1–6, 1918, and approved by the American Association of Instructors and Investigators in Poultry Husbandry.)

High Vitality the Essential

"In order to lay well a bird must have a sound body. As a first consideration a bird must be *vigorous* and *healthy*, if it is to be able to lay well. Vigor and health are shown by a bright, clear eye, a well set body, a comparatively active disposition and a good circulation."

Free from Deformities

"Further, the bird must be free from physical defects such as crooked beak, excessively long toe nails, eyelids that overhang so that the bird cannot see well, scaly legs or anything else that would keep the bird from seeing or getting an abundance of food."

Pigmentation and Loss of Fat Due to Laying

"Color or pigmentation changes. (These should be observed by daylight.)"

The Reason

"A laying fowl uses up the surplus fat in the body, especially it removes the fat from the skin. In yellow-skinned breeds, this loss of fat can readily be seen by the loss of the yellow color. The different parts of the body tend to become white, according to the amount of fat stored in the body and the amount of circulation of blood through that part. The changes occur in the following order.

"The **vent** changes very quickly with egg production so that a white or pink vent on a yellow-skinned bird generally means that the bird is laying, while a yellow vent means a bird is not laying.

"It should be recognized that all yellow color changes are dependent on the feed, coarseness of skin, and the size of the bird. A heavy bird, fed on an abundance of green feed or other material that will color the fat deep yellow, will not bleach out nearly as quickly as a smaller or paler colored bird.

"The **eyering**, that is, the inner edge of the eyelid, bleaches out a trifle slower than the vent. The earlobes on Leghorns and Anconas bleach out a little slower than the eyering, so that a bleached earlobe means a little longer or greater production than a bleached vent or eyelid.

"The color goes out of the **beak** beginning at the base and gradually disappears until it finally leaves the front part of the upper beak. The lower beak bleaches faster than the upper but may be used where the upper is obscured by horn or black. On the average colored, yellow-skinned bird, a bleached beak means heavy production for at least the past four to six weeks.

"The **shanks** are the slowest to bleach out and hence indicate a much longer period of production than the other parts. The yellow goes out of the scales on the front of the shanks first and finally from the scales on the rear. The scales on the heel of the shank are the last to bleach out and may generally be used as an index to the natural depth of yellow color of the bird. A bleached-out shank usually indicates fairly heavy production for at least fifteen to twenty weeks.

"The yellow color comes back into the vent, eyering, earlobes, beak and shanks in the same order as it went out, only the color returns much more quickly than it goes out. A vacation or rest period can sometimes be determined by the outer end of the beak being bleached and the base being yellow.

Body Changes Due to Laying

"A laying hen has a large, moist vent showing a dilated condition and looseness as compared with the hard, puckered vent of a non-laying hen.

"The whole **abdomen** is dilated as well as the vent so that the pelvic arches are widespread and the keel is forced down, away from the pelvic arches so as to give large *capacity*. The more eggs a bird is going to lay the following week the greater will be the size of the abdomen. The actual size of the abdomen is, of course, influenced by the size of eggs laid and by the size of the bird.

The Skin and Pelvic Bones

"Heavy production is shown by the quality of the **skin** and the thickness and stiffness of the **pelvic bones.** Fat goes out from the skin and body with production so that the heavy producers have a soft velvety skin that is not underlaid by layers of hard fat. The abdomen, in particular, is soft and pliable. The **sternal processes** are very prominent and generally bend outward. The thicker and blunter the pelvic arches and the greater the amount of hard fat in the abdomen, the less the production or the longer the time since production.

The Head

"One of the finer indications, but yet one of the most valuable in picking the high layer, is the fineness of the **head** and the closeness and dryness of **feathering.** The head of a high layer is fine. The wattles and earlobes fit close to the beak and are not loose and flabby. The face is clean-cut. The eye is full, round, and prominent, especially when seen from the front. The high layer is trimmer, that is, the feathers lie closer to the body and after heavy production the oil does not keep the plumage relatively as sleek and glossy but the plumage becomes worn and threadbare.

Changes in Secondary Sexual Characters

"The **comb, wattles** and **earlobes** enlarge or contract, depending on the ovary. If the comb, wattles and earlobes are large, full and smooth, or hard and waxy, the bird is laying heavily. If the comb is limp the bird is laying only slightly, but it is not laying at all when the comb is dried down, especially at molting time. If the comb is warm it is an indication that the bird is coming back into production.

The Molting

"When a bird stops laying in the summer, she usually starts molting. The later a hen lays in the summer or the longer the period over which she lays, the greater will be her production, so that the high producer is the late layer and hence the late molter. The length of time that a hen has been molting or has stopped laying can be determined by the molting of the primary feathers. It takes about six weeks to completely renew the primary feathers and an additional two weeks for each subsequent primary to be removed.

Temperament and Activity

"A good layer is more active and nervous and yet more easily handled than a poor layer. A high layer shows more friendliness and yet elusiveness than a poor bird. A low producer is shy and stays on the edge of the flock and will squawk when caught.

"While the characters discussed have dealt specifically with the current year's production it should be borne in mind that a high producer one year is, generally speaking, a high producer in all other years."

This first serious attempt to assemble, classify, define and appraise the values of the physical characters as indicating the vitality and production qualities of the domestic fowl was made at the first annual Cornell Poultry Judging School. The persons chiefly responsible for the statement quoted above were a committee consisting of O. B. Kent, chairman; W. R. Graham, H. R. Lewis, A. G. Phillips and J. E. Rice. Other instructors at the school who were present at the general meeting when the report of the committee was discussed and adopted were Resse V. Hicks, W. D. Card, Franklin Sewell, and others.

Each year since 1918 a special committee has simplified, standardized and amplified the statement. The changes which have been made as a result of eleven years of accumulative information may be observed in Chapter XIX, page 354, where the statement for 1929 is printed.

AN EARLY ATTEMPT TO COMBINE STANDARD AND PRODUCTION JUDGING

The steady increase in the knowledge of methods of judging fowls for production and the growing conviction of their soundness in the minds of many of the most progressive breeders, college workers and some far-visioned editors and judges culminated in a movement in 1919 to have production judging included in the American Standard of Perfection.

Through the aggressive leadership of several of the men prominent in the affairs of the American Poultry Association at that time, notably, Grant M. Curtis and T. E. Quisenberry, provision was made by the Association for the appointment of a committee of forty members whose function it was to consider ways and means for increasing the usefulness of the organization. Among the more important projects in the agendum was to secure proper recognition of production values in the American Standard of Perfection soon to be revised by the Association.

The " Committee of 40 " included many of the best poultry authorities in the United States and Canada, prominent breeders, editors, judges and college workers.

At the Buffalo meeting of the " Committee of 40 " the movement took definite form by the adoption of the outline of a chapter on production judging and the appointment of an editorial committee to write the chapter and provide suitable illustrations. This text was to be presented without cost to the American Poultry Association. An editorial committee was appointed to undertake the task. The persons who were drafted for this important mission were Harry R. Lewis, W. R. Graham, A. G. Phillips, W. F. Kirkpatrick, James E. Rice.

The sessions of the " Committee of 40 " at which this question was discussed were animated and at times dramatic.

On the question at issue, " Judging for Production," the " Committee of 40 " was divided rather unevenly into three groups. The first group consisted of those who were thoroughly in favor of production judging. The second included those who were mildly sympathetic but afraid to venture far. The third considered production judging distinctly revolutionary and was fearful that the newer ideas of judging for production would ruin the " fancy " and destroy the Standard. However, the longer the subject was discussed the stronger the sentiment became in favor of including a chapter on production judging in the Standard. A resolution was adopted approving the plan to write the text on production judging to be recommended for inclusion in the next revision of the Standard.

RESOLUTION OF APPRECIATION PASSED AT THE LAST MEETING OF THE " COMMITTEE OF 40 "

The final endorsement of the work of the " Committee of 40 " was in the form of a resolution unanimously adopted as follows:

> "In recognition of the splendid leadership of Grant M. Curtis, the Chairman, and T. E. Quisenberry, the Secretary of the 'Committee of 40' as shown by their vision, their efficiency and their fidelity to their responsibilities in bringing about and presiding over these meetings, the results of which we believe will be epoch making in the history of our Association, we desire to express our earnest appreciation and now pledge to them and to the American Poultry Association our united support in carrying forward to its ultimate completion the constructive work which has been undertaken."

The men who were on the " Committee of 40 " labored long and earnestly in a sincere effort to arrive at a wise decision with regard to including production judging in the American Standard of Perfection.

The committee represented a good cross-section of the representative poultrymen of Canada and the United States. Nevertheless, their plan to recognize production judging was not adopted by the American Poultry Association.

At the annual meeting of the American Poultry Association which considered the report of the "Committee of 40" the "old-line fanciers" dominated the situation. Their negative action temporarily lost to the Association the splendid opportunity to greatly improve the production quality of Standard-bred poultry and of assuming the leadership in this field. However, the inability of the "Committee of 40" to secure proper recognition of production judging in the American Standard of Perfection was not wholly lost. The widespread agitation of the value of production judging and the arguments for and against its inclusion in the Standard, caused the Standard Revision Committee to mention a few facts regarding production quality, thus giving it specific recognition. The Association also appointed on the Standard Revision Committee a worthy representative of production judging, Harry R. Lewis, who unfortunately was not given an opportunity to meet with the committee.

This negative action of a comparatively few fancier breeders delayed but did not stop the advance of production judging. In fact the opposition to production judging served to stimulate it among the great mass of commerical breeders and many of the standard breeders and college men who moved steadily forward until to-day, practically the entire well-informed poultry world has come to recognize the great importance of selecting for production by physical examination, in fact, the absolute necessity of it in breeding standard as well as commercial grades of poultry.

Since that time the inclusion, in the last two revisions of the Standard, of more and more information regarding the production characteristics of poultry is encouraging proof of a recognition of the soundness of the principles of production judging and of their gradual and ultimate adoption by all classes of poultrymen.

It is difficult to estimate how much greater our advance would have been if the editorial committee had been authorized by the Standard Revision Committee to prepare for publication as a part of the Standard the text on Production Judging as here outlined.

REPORT OF THE SPECIAL COMMITTEE OF THE COMMITTEE OF 40 ON THE INCLUSION OF A CHAPTER IN THE NEXT 'STANDARD OF PERFECTION' WHICH SHALL DESCRIBE AND ILLUSTRATE THE PHYSICAL CHANGES TAKING PLACE IN FOWLS DUE TO PRODUCTION. 1919.

The Committee submit the following outline covering such subject matter content for your consideration and suggestions; with the understanding that the complete text, together with illustrations and descriptions, will be prepared on the basis of the approved outline and submitted to the Revision Committee before the next Annual Meeting of the American Poultry Association.

The Committee wish to state that in preparing this outline and in planning the subject matter to be included in this Chapter, it has worked on the hypothesis that its function was to define and picture only these factors concerned with the physical changes due to production and it has studiously avoided any reference to or discussion of breed types or characters as such.

This Chapter is designed to show the changes which take place in any standard bred bird due to the development and activity of the reproductive function.

OUTLINE

The Influence of Reproduction upon the Physical Characters of Domestic Fowls

Introduction:

The present *Standard of Perfection* has given us our foundation, by and through which our modern breeds and varieties have been built. It has made possible the uniform development of breeds and varieties through the standardization of characters.

The present *Standard describes* the breed or variety in *only one condition* of development: That is the most perfect physical condition, which is the time when the bird is just finished, in the blush so to speak, and is just coming into producing condition.

The purpose of this chapter is to describe and illustrate the physical changes which take place in the appearance of birds during varying *stages of production* and *non-production*.

A complete knowledge of these changes will distinctly serve the Poultry Industry in the following ways:

(1) It will enable all classes of poultrymen to intelligently cull their birds to eliminate the low producer.

(2) It will allow the breeder to select high producing individuals for use in his matings without the expense of trapnesting.

(3) It will enable the breeder to correctly and intelligently select birds for production classes at poultry shows.

(4) It will serve as a guide and instruction to judges in awarding premiums at such production classes at poultry shows.

(5) It will serve as a text to students in studying culling methods and the behavior of birds in production.

PART I

THE REPRODUCTIVE FUNCTION OF THE DOMESTIC FOWL

(*a*) Egg Production a Reproductive Function:
  1. Influence of domestication and breeding.
  2. Present production.
  3. Economic importance of egg production.

(*b*) The Reproductive Organs:
  1. Description of Reproductive Organs.
  2. Development of the Egg.
     I. Process.
     II. Time.
  3. Great drain upon vigor, nutriment and pigment within the body of the bird, due to production and its influence upon physical changes.

(*c*) The Development of the Reproductive System:
  1. Development of the reproductive organs of the young chick through one complete cycle of production and following dormancy.
     (Illustrated)
  2. The active ovary; its condition and appearance and influence on physical characters.
  3. The inactive ovary; its condition and appearance and influence on physical characters.

(*d*) Factors influencing Ovarian Activity:
  1. Feed.
  2. Temperature.
  3. Temperament.
     Disposition.
     Intelligence.
  4. Season.
  5. Climate.
  6. Age.
  7. Growth or development.
  8. Weight.
  9. Sanitation.
  10. Parasites, etc.

(*e*) Distribution of Production:
  1. Precocity or early training.
  2. Intensity, or rhythm and cycle.
  3. Persistency or continuance of production.

NOTE: Above to be fully illustrated and all terms defined and to be discussed for high, medium and low producers.

PART II

PHYSICAL CHANGES DUE TO PRODUCTION

(*a*) Pigmentation:
  1. Statement of fact and explanation of same.
  2. Order of disappearance and reappearance.
  3. Meaning and use of this pigment factor.
  4. Factors affecting pigmentation.
    I. Production.
    II. Food.
    III. Natural depth of fat.
    IV. Intensity of pigment.
    V. Physical condition of bird.

(*b*) Body:

All changes here must be considered as relative, that is in proportion of the size and weight of the bird.

  1. General loosening up of tissues due to pregnant condition.
  2. Bony frame work:
    I. Deepening of body, capacity.
    II. Full breast.
    III. Pelvic arch
      Spread
      Thickness.
    IV. Lateral processes.
  3. Quality.
    I. Skin.
    II. Abdomen.
    III. Vent.

(*c*) Secondary Sexual Characters:
  1. Comb.
  2. Wattles.
  3. Earlobes.
  4. Masculine females.
  5. Nesters.

(*d*) Plumage:
  1. Relation of moult to production.
  2. Time.
  3. Speed.
  4. Order.
  5. Factors influencing.
  6. Influence of length, shape and fluff of feather upon maturity, condition of skin and fertility.

(*e*) Constitutional Vigor and Vitality:
  1. Natural ability of a bird to stand up under production.
  2. Evidence of vigor.
  3. Factors influencing.

PART III

AN ACTUAL STUDY OF INDIVIDUAL BIRDS DURING DIFFERENT CONDITIONS OF OVARIAN ACTIVITY

1. Pullet in blush or in exhibition condition.
2. Same pullet in heavy lay.
3. Same pullet during the moult.
4. Same bird as a hen when back in show condition.

NOTE:

(*a*) Above to be illustrated in colors.
(*b*) A number of birds to be used representing typical examples of common breeds.
(*c*) The appearance and changes as seen at each stage to be discussed section by section.

The above Report and Outline is respectfully submitted for your consideration and we await your further instructions.

(Signed)

CHAPTER III

CONSTITUTIONAL VIGOR AND ITS RELATION TO PRODUCTION

THE MOST IMPORTANT FACTOR IN BREEDING AND JUDGING IS VITALITY

Since the foundation of all improvement is good health the first step in good breeding and judging is to eliminate the unfit.

Fowls differ widely in their vitality. Some are physically strong; others are weak. Some are born strong and later lose their vitality through neglect or misuse. Whatever may be the cause or causes of the weakness, these individuals are unprofitable and should be discarded. Without a robust constitution, fowls cannot eat well, hence cannot grow naturally and therefore cannot produce either flesh or eggs profitably.

The most important object in the successful handling of poultry is to eliminate from the flock the unprofitable individuals because by so doing one raises materially the average production of the flock and at the same time increases the net profits per bird. Frequently the weak, undeveloped and undesirable birds cause sufficient losses to overbalance the profits of the best birds in the flock.

VITALITY IS DISTINGUISHABLE BY PHYSICAL CHARACTERS

Differences in the constitutional vigor of poultry may be recognized when individuals are studied in detail, section by section, remembering that there is no one distinguishing characteristic which, when taken alone, will always prove true. A person must base his best judgment on the *composite assembling and consideration of several distinguishing characteristics*. This method, if properly applied, will prove sufficiently reliable to make it workable.

Animals differ in their constitutional vigor primarily in two respects; first, as to their general behavior; second, as to their body characters.

BEHAVIOR

1. Activity.—Action is the physical expression of energy. Birds of high or low vitality show it in their activity. They show their physical vigor by their courage, their intelligent interest in what is going on, and by their running, flying, foraging, scratching and fighting. Birds of low vitality are inactive, tired; do not have good recuperative powers and succumb easily to hardship and neglect. A person who thoroughly understands the distinguishing characters indicating high and low vitality does not have to look long at chickens from the baby chick to the mature fowl to see which are vigorous and healthy and which are weak.

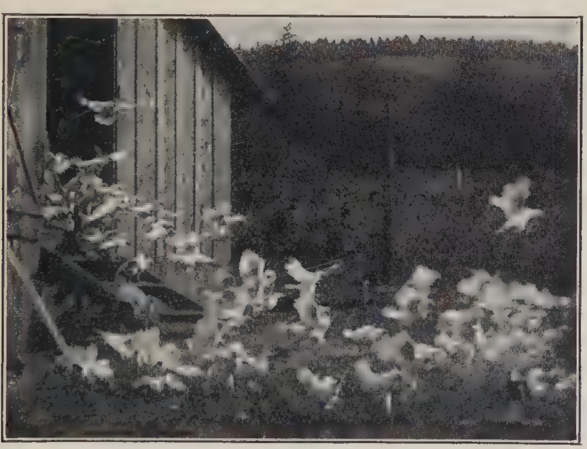


Fig. 20.—Action—an Indication of Vitality.

Fig. 20 shows a group of pullets coming from a brooder house. Any one would know whether or not these chickens are of low or high vitality. Actions speak louder than words. They are up in the air and have energy to spare. If they had less vitality they would come out more slowly and some of them might have to be pushed out. Such slow actors have low vitality and should be discarded.

Is there any question about the vitality of the chicks shown in Fig. 21? Are they of high or low vitality? They are alert, lively in action, upstanding, with heads in the air. Note the plump, blocky, parallelogram-shaped bodies. Particularly, observe the fine, large, close-fitting wings that look like white pads on the body. Note the full crops. The eyes stand out like shoe buttons. All of these characteristics are the unmistakable signs of high vitality.

Fig. 21.—Alertness—a Mark of Good Health.

Fig. 22 at the top shows a group of White Leghorn chicks. Observe the great contrast between those designated by the letter A as compared with the three marked B. It is quite possible that the B chicks are suffering from bacillary white diarrhea or coccidiosis. Whatever may be the cause they are in violent contrast in appearance with the three sturdy A chicks, which have large wing pads held up close to the body, and tails erect as compared with the drooping wings and tails and humped up position of the low vitality chicks. The well-developed shape of the heads and prominent eyes of the A chicks indicate the manner in which a difference in vitality at an early age is responsible for normal or abnormal growth, which may increase or decrease as the chick grows older.

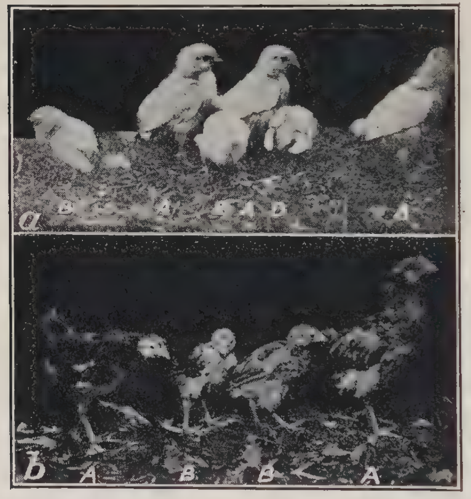


Fig. 22.—High and Low Vitality in S. C. White Leghorn and S. C. Rhode Island Red Chicks.

a. Chicks 10 days old. Note that the chicks *A* are of larger size, with better developed wings and tail, and with feathers close to the body, as compared to the smaller bodies, and more ruffled, less developed plumage of chicks *B*.

b. Four chickens of the same variety and age, reared under the same conditions. The difference in size is apparently due to an inherited weakness.

In the lower section of Fig. 22 are four S. C. Rhode Island Red chickens of the same age and reared under the same conditions. The striking contrast between the two marked A compared with the two marked B is so great that one would assume that there was a difference of several weeks in their ages. The difference, however, was due either to an inherited weakness from the parent through the egg or some cause not accounted for in the management.

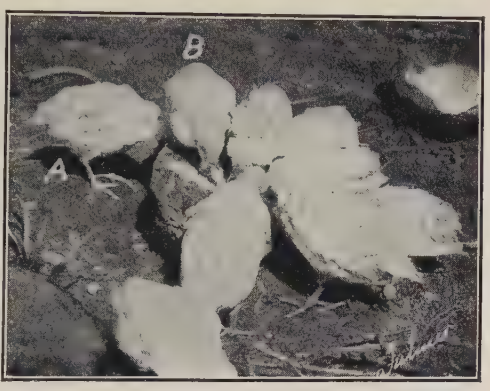


Fig. 23.—Low Vitality Chickens. They Show It.

2. Attitude.—The attitude expresses the physical fitness of a bird. The physical condition of a bird is expressed in its posture. In Figs. 25, 26, 27, 28, 29 and 30 are assembled illustrations of birds whose attitudes and postures indicate wide extremes of physical vigor and weakness. Several of these are typical and should be quickly recognizable.

Are the chickens in Fig. 23 of high or low vitality? Look again. Note the thin shanks and long toes of the chick A at the extreme left and the long beak and sunken face and eye of the next chick B to the right, and the rough plumage of all of them. They all have pale beaks, faces and shanks. One should shun these evidences of low vitality as he would a pestilence. This condition of low vitality is the result of the disease, coccidiosis. These are the victims of unfavorable circumstances. Although they might apparently recover they would be likely to show evidences of their early handicap during the formative period.

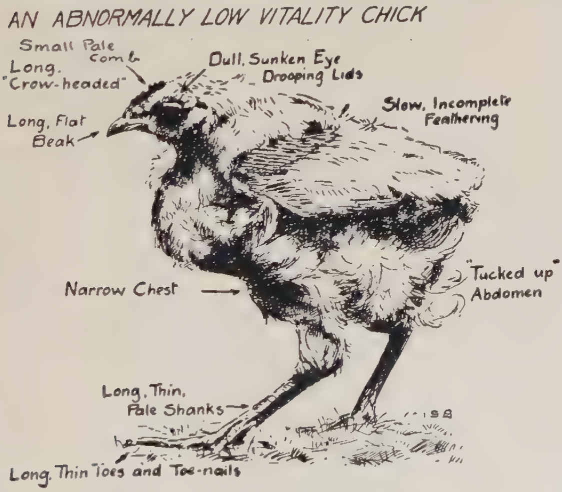

AN ABNORMALLY LOW VITALITY CHICK
Small Pale Comb
Long. "Crow-headed"
Dull, Sunken Eye
Drooping Lids
Slow, Incomplete Feathering
Long, Flat Beak
Narrow Chest
"Tucked up" Abdomen
Long, Thin, Pale Shanks
SB
Long, Thin Toes and Toe-nails

Fig. 24.—A Poultry "Derelict."

Fig. 25 illustrates most strikingly many characteristic points of difference between two Barred Plymouth Rocks, A and B. A is a large healthy capon and shows the effeminate characters which a male assumes when he has been unsexed. Note especially the effect upon the size of the comb and wattles, type of plumage and carriage as compared to B. B is a splendid example of a vigorous, virile, rugged, egg type Plymouth Rock (bred by W. R. Graham, Ontario Agricultural College, Guelph, Canada). One can almost hear him "talk" and see him move, so vividly has the camera caught his attitude and expression.

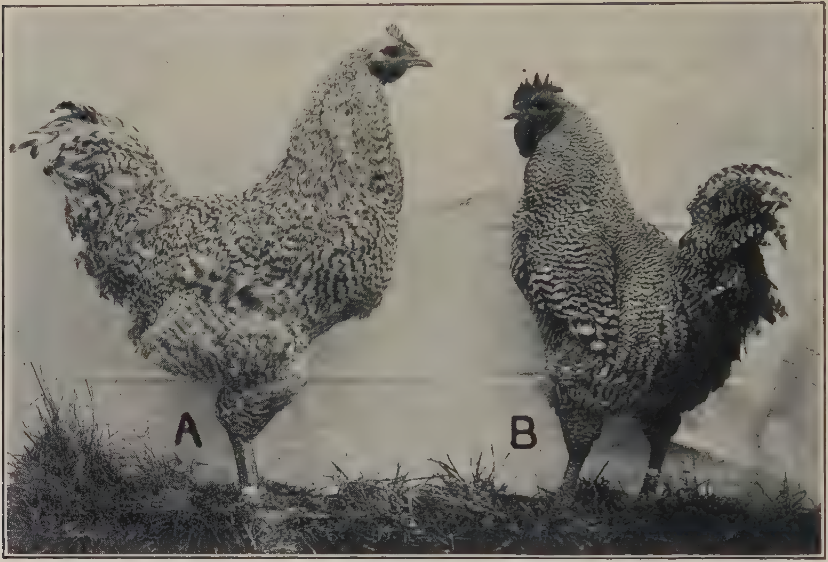


FIG. 25.—Unsexing Did It. What a Contrast!

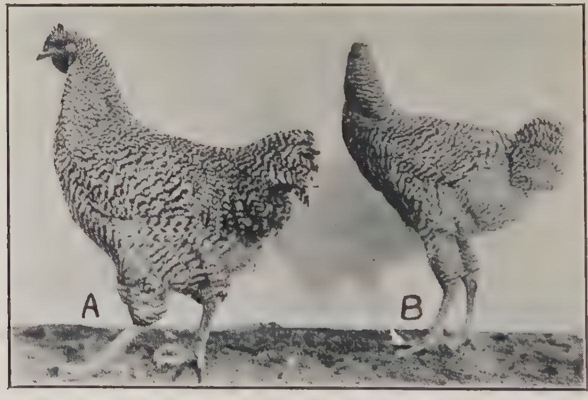


FIG. 26.—Barred Plymouth Rock Cockerels of High and Low Vitality. There is no difficulty in distinguishing them.

While B does not weigh as much as A he possesses vastly more courage, vitality, and recuperative power. Note his bright, glossy plumage and the challenge in his attitude.

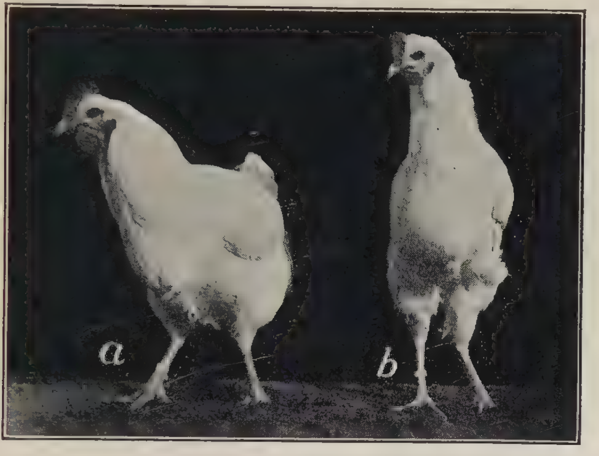


Fig. 27.—High and Low Vitality White Plymouth Rocks.

Figs. 26 and 27 show side and front views of two high vitality Plymouth Rocks of the Barred and White varieties, contrasted with low vitality individuals of the same varieties. All of the characters which were pointed out in previous studies are to be seen here in contrast. In addition note the difference in width between the shanks as determined by the width of the bodies. The bodies of the high vitality birds in all of the illustrations are wider as well as deeper. Observe particu-

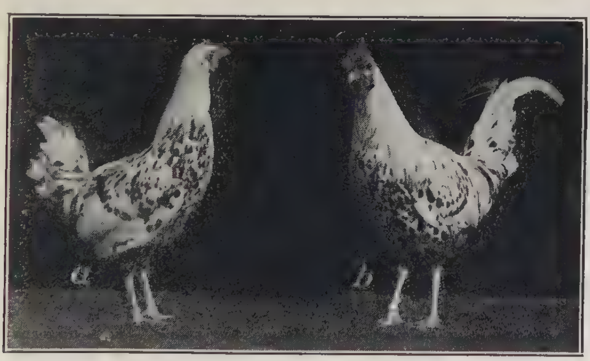


Fig. 28.—Silver Spangled Hamburg Cockerels of Low and High Vitality.
Note especially comb and plumage development.

larly the lack of physical power in the weak heads of the low vitality birds.

Figs. 28, 29 and 30 bring out the salient differences in types of high and low vitality Silver spangled Hamburgs, Single Comb White Leghorns and Single Comb Rhode Island Reds. Not only is the difference in size conspicuously apparent but all the other characters, size and shape of shank, size and shape of comb, size, shape and carriage of tail, etc., show contrasts.

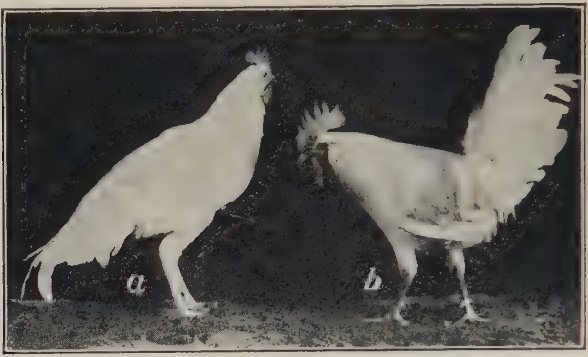


FIG. 29.—Low and High Vitality Single Comb White Leghorn Cockerels.

Note especially attitude and carriage of the low vitality individual.

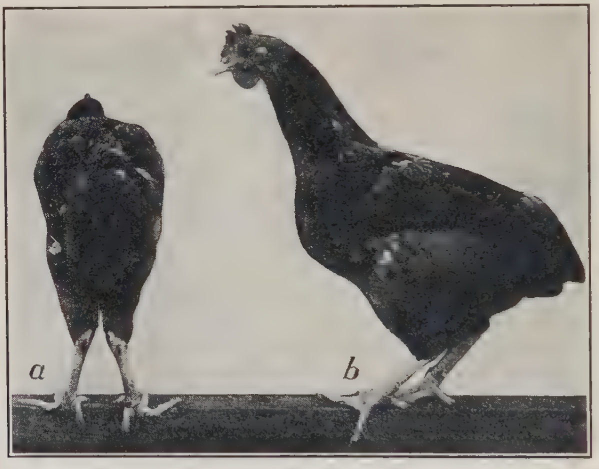


FIG. 30.—Low and High Vitality Rhode Island Red Cockerels.

Note the listless, "cowed" attitude, drooping rump and "knock knees" of the low vitality individual on the left. These characters are in direct contrast to the larger, more masculine individual on the right.

When birds are lacking in vigor they take an easy position by letting the body relax. They do this when standing or squatting on the shanks. Tucking the head under the wing is quite characteristic of lowered vitality, but since the bird sometimes takes the same position when normal and resting, this posture cannot be used alone as a positive indication of low vitality. When frightened, birds either run, fly or seek to hide for protection if they are conscious of their inferiority. In this instance weakness is only relative to the strength and courage of the opponent. If the more vigorous opponent is removed the element of fear is no longer responsible for the " inferiority " complex of the weaker and he automatically assumes the rôle of boss over those weaker than he. The relativity of vigor is well illustrated by the effect of the operation of dubbing. The males which have had their combs removed or reduced in size by dubbing realize very soon afterward that they now have a great fighting advantage on account of the absence of large combs and wattles which may have been heavy and therefore always furnish a vulnerable point of attack. Weaker males that have been dubbed frequently become aggressor over the former champion who has his full regalia of secondary sex characters, the comb and wattles, as a handicap. Hence courage or fear as a test of vigor always must be relative and not absolute. In order to judge accurately one must have clearly in mind a bird of the same breed, sex and age that measures up to a high standard of excellence for vitality and compare others with this standard.

If a low vitality chicken had been made to order it could not have embodied all of the physical evidences of low vitality any better than the individual shown in Fig. 24. Point by point each character mentioned may be found true to perfection of imperfection. The reader is urged to shut his eyes and try to recall the points of contrast between high and low vitality individuals shown in Figs. 26, 27, 28, 29 and 30.

3. Crowing, Cackling and Singing.—Vocal expression reflects physical condition. The crowing, cackling and singing of birds indicate their reproductive vitality. They are expressions of sex emotions. The birds having strong sexual vitality and activity usually crow longest, loudest and most frequently. In the early days when cock fighting was a popular pastime, this was one of the common tests of good fighters before entering them in the battle. Large numbers of birds were selected for fighting purposes on account of their general appearance. These were placed so that they could see, but could not reach the others. They were then allowed to show their crowing capacities (telling what they could do, if they had a chance). Crowing is a challenge to combat. Generally a challenge is not issued unless the challenger feels that he has the strength, endurance and skill to—as Josh Billings expressed it—" back up the crow with." (Figs. 29 and 31.)

Any one may easily verify the accuracy of the crowing, cackling and singing characteristics of fowls as indicative of constitutional vigor, by observing them carefully when the strong is in the presence of the weak. Almost invariably the high vitality birds will crow freely, whereas those of low vitality seldom, if ever, crow unless at a safe distance. So, too, a flock of hens may be watched unobserved, and it will be found that almost never will the low vitality birds be singing or cackling. They usually will not be laying, or if laying, will not be feeling strong physically.

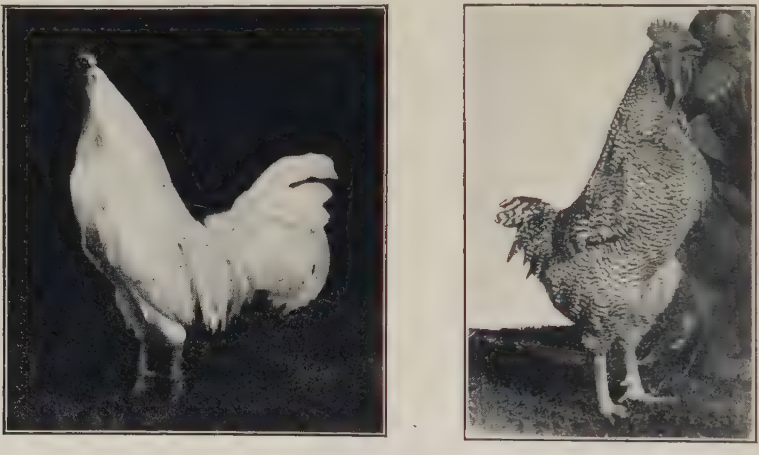


Fig. 31.—Crowing Is a Challenge to Combat.

Cackling is a mating call. It is closely associated with egg production. The best laying condition is also the best physical condition. Since cackling usually follows the laying of the egg the oviduct is then clear for the passage of sperm of the male. This, then, is the most favorable time for mating. A large proportion of the matings take place late in the afternoon before the egg to be laid next day reaches the stage where it would stop the sperm from ascending the oviduct following copulation. Singing and cackling are the joyous expressions of good health and good health is a necessary basis of continued reproductive activity. The laying hen is the happy, singing, cackling hen. Good health therefore is the first essential to good egg production.

4. Gallantry and Coquetry.—These terms express the attitude of the male and the female toward each other. They express the physical vigor of a male and a female. Masculinity and femininity are shown by the behavior of the two sexes toward each other. Gallantry is an expression of a male's masculine characteristics in assisting and defending the females. A good male generally is generous and courteous toward the females and will call them to eat whatever he finds that is good. Some of the best males will deny themselves food to the extent of personal injury on account of this natural characteristic. The best males are the most talkative to the females.

After observing other important factors a person should watch the males to see the way in which they call the females. For this purpose especially attractive food should be thrown to the flock of females where the males are running with them and can be observed under normal conditions. Usually associated with the generosity on the part of the male is his courage in the defense of the flock—fighting anything regardless of size.

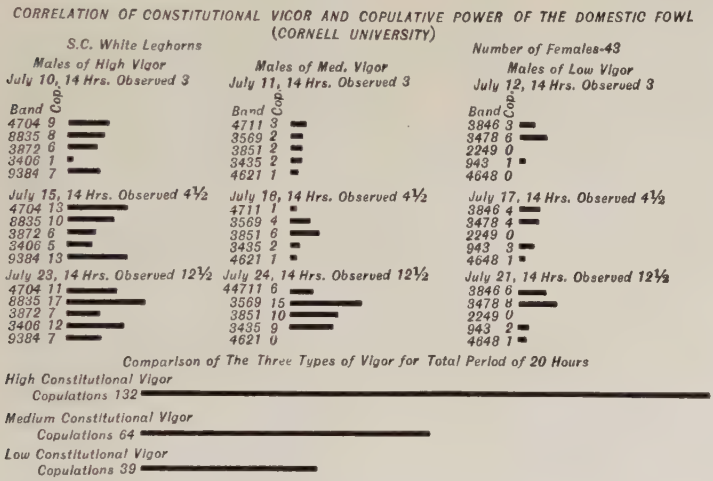


FIG. 32.—Sex Urge and Vitality Mathematically Expressed.

The basis of sex attraction is the inheritance of the reproductive function combined with physical vigor. These two factors determine mating frequency. Fig. 32 shows graphically the frequency of matings of the three groups of males shown in Fig. 33. The males were picked by physical examination. The comparison between the three groups was made at the close of the breeding season. The males were selected entirely by evidences of a difference in the vitality of the birds by use of the best known characteristics indicating vitality. The tail of each bird in each of the three groups was of a different color. Five different colored diamond dyes were used for individual identification. The result of the mating observations are shown in Fig. 32.

The birds in Group *a* were by far the most active. They were so busy that all of the attempts to photograph them caught them in aggressive action. In Group *b*, the males were alert and active but not conspicuously so, but those in Group *c* were slow in action. All of the fifteen males in the test evidently were of good health but they differed in action. The difference between 132, 64 and 39 copulations of five high, five medium and five low vitality birds represents a vital factor in producing fertile eggs.

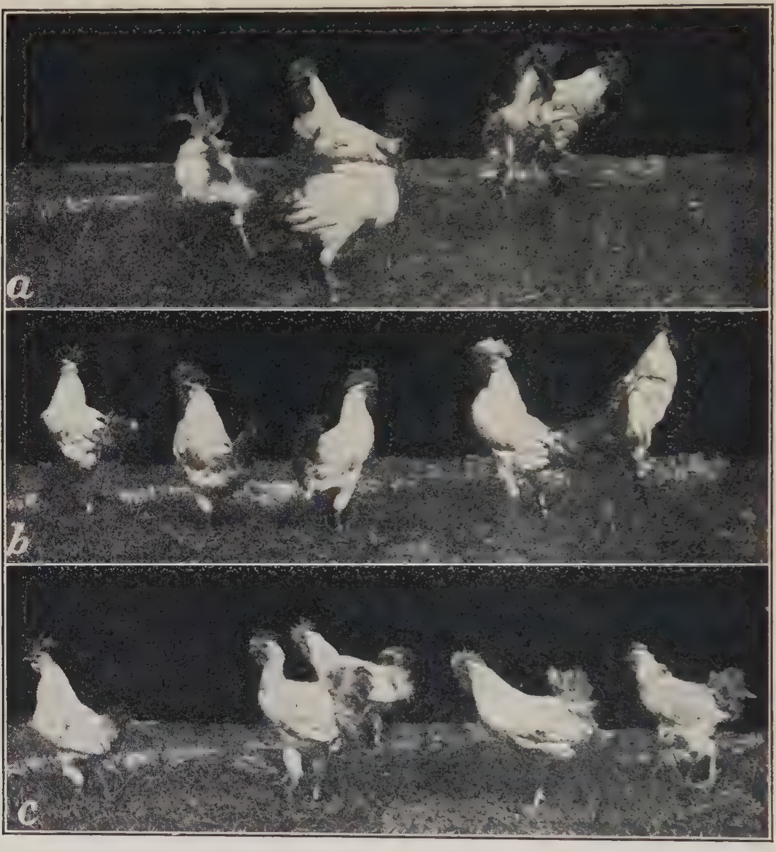


FIG. 33.—Constitutional Vigor Is Indicated in Males by Frequency of Mating and Actions. Each Bird's Tail Was Colored for Identification.

a. Birds of high constitutional vigor.
b. Birds of medium constitutional vigor.
c. Birds of low constitutional vigor.

Generally, although not always, the most vigorous males, when with a large number of each sex, will carry with them a larger group of the females. For example, let four males of decidedly different degrees of constitutional vigor and gallantry run with a large flock of females long enough to become well acquainted and it will be observed that a larger proportion of the females may be expected to go with the more vigorous and gallant males and a smaller number with the weaker, less masculine males.

"Coquetry" in the female is less pronounced than are acts of gallantry in the male. They come at the call of the male and by their actions indicate a receptive attitude for mating.

5. Early Rising and Late Retiring.—The time fowls spend on the perches as compared to the time in action on the ground or floor, and the time of going to and leaving the roost, are excellent indications of health and vitality and conditions of laying. Fowls that frequent the perches during the day give evidence of being out of condition at least temporarily. This evidence should not be accepted as final since frequently high producing hens go on the perches during the day to rest, especially when the days are long, either naturally or artificially. A mid-day rest is normal.

Physical weakness is generally indicated by a desire to rest. When a fowl is out of condition it seeks seclusion, and the roosts generally furnish the most natural retreat. Hens, like people, go to bed when they are sick or tired. The most vigorous birds generally are the most productive. Usually they are the last to go to roost at night. They are also the first to leave the perches in the morning. This is because the fowls possess vigorous good health and good appetites.

6. Appetite.—Birds which are physically strong and active have good appetites. They digest their food normally during the night and at the first sign of dawn are down on the floor or out in the field, eagerly searching for food. Action waits on appetite, and good appetite waits on good digestion. The way the birds scratch deep holes in the litter, the eagerness with which they seek food, if regularly and properly fed, are a very reliable index to their health. A good appetite, associated with rapid growth or heavy egg production, or both, is one of the best indications of good digestion and good health—a fundamental characteristic of constitutional vigor. High producers will be found most frequently at the mash hoppers. They usually go directly to eat or drink when released from the trapnest.

7. Fullness of the Crop.—The amount of food found in the crop of birds on the perches at night is a very reliable guide to the health and productive condition of the fowl. The bird of good vitality, especially if laying heavily, generally goes to roost with the crop full, whereas birds of low vitality frequently have little or no food in the crop. The amount of food in the crop at night is a fair measure of the appetite of the bird during the day and the demand of the body for food. Regardless of what one may feed, birds of low vitality seldom have much food in the crop and it passes through the digestive organs slowly. When properly fed, fowls generally eat more than their body requires. The body demand for food is in proportion to performance as represented by body growth, egg production and exercise.

CONSTITUTIONAL VIGOR IS SHOWN BY BODY CHARACTERS

The most important body characters indicating vitality are those of shape, size and weight of the body. Unquestionably there is a very strong correlation between the shape of body and the physical condition of fowls of the same variety. In order that we may see these differences more clearly we must, of course, have strong contrasts between the very strong and the very weak. Frequently one will have to discriminate carefully in order to see the fine distinction between individuals that show moderate and those that show high constitutional vigor. It is, however, comparatively easy for one to observe the body characteristics, such as shape and size, when one fowl is decidedly stronger than the other. The body shape that most surely indicates low vitality in a bird is the natural result of continued low physical condition and inactivity, poor appetite and slow growth. The body is the physcial expression of the condition of health. All animals take on certain physical characteristics of body attitude and type which reflect their physical condition and state of health. Low vitality results in abnormal, incomplete or faulty development by which certain parts of the body grow out of proportion to other parts. On the other hand a bird of high vitality has a body shape that indicates large disgestive capacity and a full normal development of all parts of the body. For example, a fowl of high vitality generally has a reasonably long keel, a fairly broad back, a deep, full abdomen, full crop and prominent breast. These are the three dimensions, length, depth, and thickness which determine cubic capacity. Note the capacity of the high vitality birds in Figs. 26, 27, 28, 29 and 30.

A bird of normal development of all body characters for the variety will have a body shape that in outline, when viewed either from the side, front, rear or from above, will more nearly approach filling a parallelogram. In contrast, birds of exceedingly low vitality are more likely to have a short keel, narrow body, flat breast, tucked-up abdomen, approaching the shape of a triangle.

Fig. 34 shows by geometric measurements the marked contrast, when viewed from the side, between the body shape of the strong and weak Barred Plymouth Rocks whose photographs are shown in Fig. 26. By following the body outline and noting the points where it fills or fails to fill a parallelogram the difference in type becomes very apparent. Perhaps the greatest contrast is evident in the space between the keel and the hocks, showing the shallow body that comes down near the hocks. The shallow breast and tucked-up abdomen of the low vitality bird leave large areas of space of the parallelogram unfilled. The size of shank bones differs greatly. Parallel examination of the two birds shows that the high vitality individual has a compact, blocky body as compared to the longer jointed, spindling, stilty type of the low vitality.

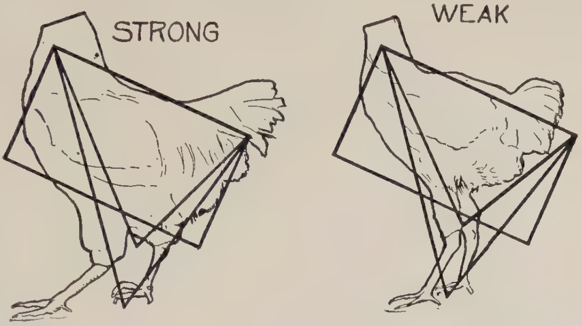

STRONG
WEAK

Fig. 34.—The Way in Which Birds of High and Low Vitality Fill a Parallelogram and Two Triangles.

This clearly brings out the points of weakness in development of keel, breast and abdomen in the low vitality bird.

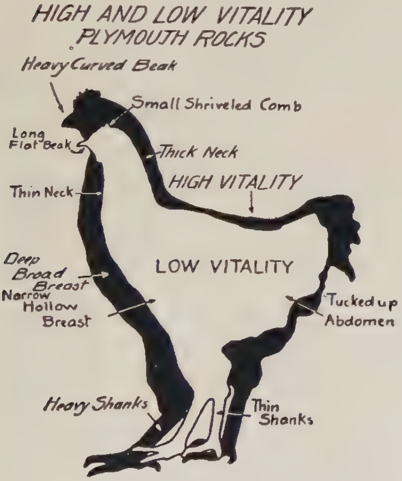

HIGH AND LOW VITALITY
PLYMOUTH ROCKS
Heavy Curved Beak
Small Shriveled Comb
Long Flat Beak
Thick Neck
Thin Neck
HIGH VITALITY
LOW VITALITY
Deep Broad Breast
Narrow Hollow Breast
Tucked up Abdomen
Heavy Shanks
Thin Shanks

Fig. 35.—The Outline of a Low Vitality Individual Superimposed Over That of a High Vitality Bird.

Fig. 35 shows again the two Barred Plymouth Rocks of Fig. 26; they are here contrasted in black and white. The low vitality bird is shown in white and is superimposed over the high vitality bird shown in black, in order to reveal the points of difference. Careful observation, section by section, will reveal the unmistakable characteristics which distinguish birds of high vitality from those of low vitality.

The modification of parts through failure to develop normally indicates that the digestive tract either is not normal in size or is not functioning properly. A bird normally having high vitality may be temporarily in a condition of low vitality and later recover the normal condition. A fowl's body shape varies materially from time to time during the year and from youth to old age. Its physical characters may change—in fact normally do change—from time to time during the year to such an extent as to make the bird scarcely recognizable as the same individual. Hence, every bird must be judged by its vigor only at the time of observation. A fowl temporarily out of condition would show many of the characters indicating low vitality. The same fowl, after a period of rest and recuperation, might not show low vitality characteristics but would be judged as a vigorous bird. In this respect hens do not differ from people. It is essential, first, that we be able to recognize the symptoms of low physical vigor and then to discover the cause before the condition can be remedied, or prevented. Diagnosis is an important phase of judging.

High vitality does not necessarily mean high production. Sometimes a fowl may be non-productive, or nearly so, and show the highest possible physical vigor. This is because it has not used its energy in laying. On the other hand, high production may result in producing low vitality at the close of a long period of laying. After a good rest the fowl would be likely to recover her normal body type.

The shape of the body is as true a characteristic by which high and low vitality may be distinguished in the case of young chickens as it is of the mature fowls. The baby chick of low vitality, like the older fowl, has a hollow breast, tucked-up abdomen and a narrow keel, which give it a triangular shape instead of that of a parallelogram. (Figs. 22 and 23.)

The skeleton of the high vitality bird differs from that of the low vitality individual. A detailed comparison, section by section, of the extremes in high and low vitality types shows an interesting example of the law of correlation of the parts of a fowl. A bird of extreme low vitality of long standing would be likely to possess a long, thin beak and head, a long, thin neck, long, slender body, long thighs and shanks and long, thin toes and toe nails. The opposite would be true of the high vitality birds of the same age, sex and breed. They would be shorter, thicker and heavier. The striking comparison is between the stocky, compactly built type of frame work of the high vitality fowl as compared to the slender, spindling, stilty types of birds.

MUSCULAR DEVELOPMENT AS AN EVIDENCE OF VITALITY

The muscular system of the high vitality bird differs from one of low vitality in firmness, size and strength. The breast muscles on either side of the keel, the muscles of the pubic bones, the face and the eyes are the places where physical condition of the birds can be most quickly detected.

Plump, well-developed breast muscles are found on birds in good physical condition. Thin breasts, making a sharp keel, are indicative of low vitality and poor health.

The condition of face which indicates the highest state of vigor is clean, bright and lean as compared to either extreme of the thin or sunken face to the extent of emaciation, or the fat, bloated face of the sluggish type.

The eye truly is the mirror which reflects the health of a bird. By its dullness or brightness the eye flashes the health and vigor of the whole body. The eye that stands out prominently from the head shows a healthy condition of muscular development which holds the eye in proper position. The eye that is sunken and eyelids that are droopy indicate that there has been a shrinking away of the muscles back of the eye which causes them to sink into the socket.

The shanks and toes, although slower in changing their condition, nevertheless, on account of being visible, are commonly used to indicate vitality by color, shape and size.

Size and Weight

Generally the size and weight of birds when considered together are a fair measure of vitality, assuming that birds of the same variety and age are compared. Birds of high vitality generally grow rapidly, and are large and compact for birds of that variety. (Figs. 26, 27, 28, 29 and 30.) Size alone or weight alone, however, would not be a sure indication of vitality. Birds may grow very large in frame and be weak physically as compared to birds of the same variety and age that are smaller, more solid and more active. Therefore, we must not confuse vitality with size or weight alone. We often find birds of medium size and weight that are more vigorous, more courageous, more gallant and in every way birds of greater vitality than larger birds of the same age and variety. Birds of high vitality may use their energy by activity early in life or by permature reproduction to such an extent as to prevent large size; whereas other birds having less vigor and action, simply because they are lazy, phlegmatic and easy-going, will grow large in size. (Fig. 25.) In a test of physical endurance, size and weight are important but not deciding characteristics. Other factors being equal, such as activity and compactness, the larger and heavier birds would be likely to be superior. However, we must always couple the performance of the bird with its size and shape and not make the mistake of thinking that the bird is vigorous just because it is large.

In a certain flock of Rhode Island Reds, recently used for demonstration purposes, there was one cockerel that was much smaller and more active than the others. He was selected for his superior constitutional vigor. The owner remarked that this cockerel had caused him " more trouble than all of the others in the flock put together." He weighed at least one pound less than any of the others of the same age and breeding, but nevertheless he had more vitality and energy, and apparent grip on life than any of the others.

FIVE PRINCIPAL CHARACTERS

A bird of high vitality should possess five principal characters: (1) size, (2) weight, (3) type, (4) reproductive power and (5) action, which, when taken together, represent the true measure of a fowl's vitality. If a male or female is unsexed the bird may grow larger but will be weaker in action and disgestion and more subject to disease. Capons, for example, are less vigorous and are more likely to succumb to hardship than fowls under normal conditions. Nevertheless, they continue to grow large, but in doing so frequently take on characters which indicate physical weakness. (Fig. 25.)

Head and Beak

Often there is a correlation between the shape of body and other characters. This is particularly true of the head. In the case of high vitality, one is likely to find associated with the solid compact, blocky body, a broad, round head with a short, heavy, curved beak, short, thick neck and a similar development of other parts. One would expect to find with the long, thin body, a long, thin neck, thin head and beak. The bird of decidedly low vitality is generally spoken of as having a crow head, which is a long, thin, flat head with a long, thin, flat beak, and sunken and droopy eyes.

If a bird fails to grow well because of inherited or acquired low vitality, it is finally indicated by a tendency of certain parts to grow out of proportion to other parts of the body. It appears that if any part of the chick is to grow, it will be the beak, toes and wings. These are the parts most needed by the chick to enable it to survive. The feet and wings enable the chicken to escape from its natural enemies. This is a wise provision of nature.

Comb, Face and Wattles

Large, bright-colored, warm and soft comb and wattles are more likely to be found on birds having high vitality than on those of low vitality. The color of the comb is a very reliable indication of vitality.

It may be said truly that fowls carry their health certificates on top of their heads. One of the most conspicuous indications of physical debility, symptoms of nearly all poultry diseases, is the color, texture and the size of the comb. The size, color and texture of the comb indicate the quality and circulation of the blood. (Figs. 26, 27, 28, 29 and 30.)

The comb, wattles and earlobes are secondary sexual characters and are almost a perfect indication of the activity of the reproductive system; however, they are not an absolutely infallible guide. Sometimes a fowl may continue to lay until she has exhausted her vitality to such an extent that it will be shown by a pale and shrunken condition of the comb. The comb is a better indicator of the physical vigor than it is of the egg producing condition of a fowl. Whatever is true of the condition of the comb, as indicating health and production, is nearly equally true of the face and wattles and other surface head parts.

EYE

Large, wide-open, bright, round eyes as compared to dull, sunken, droopy ones are exceedingly accurate indications of vitality. The real meaning of this character as an indication of vigor and good health is seen more quickly through the bright expressive eye than it is, perhaps, by any other single character. Birds of low vitality have tired, sleepy eyes, notwithstanding the fact that they are first to roost and last to rise. (Figs. 25, 27 and 29.)

PLUMAGE

The amount, rapidity of growth, closeness and brilliancy of the plumage are all excellent indications of health and vitality. This is shown particularly in the case of young chickens and fowls during the molting period. Fowls of high vitality molt normally—that is, shed a few feathers at a time and quickly grow new ones to take their place, and they complete the molting process quickly. They have power to recuperate. Generally birds of high production continue to lay late in the fall and therefore do not molt until November or December. In this instance the inherited tendency to produce eggs has, in a measure, overcome their normal tendency to molt. If, however, the birds are of high vitality, as generally is the case with the very high producers, they molt quickly when once the process begins. Birds of low vitality sometimes fail to molt. These usually may be recognized by their evidences of poor health.

Irregularly and thinly feathered birds usually are of low vitality. Young chickens that grow their body feathers slowly are generally deficient in vitality. (Figs. 22 and 23.) Fig. 36 shows the spread of wings of two White Leghorn chicks of the same age. A is of high vitality; B is weak. The body development of A is normal in proportion to wing growth. Both wings and body are good. The body of B was smaller in proportion to wing growth and both are inferior to A. If B had not been shown in contrast to A and the age had not been known the untrained observer might have concluded that the wings were growing too fast for the body. On the contrary the body was not growing fast enough for the wings and neither were growing fast enough for normal growth. Slow and irregular feathering is one of the best evidences of low vitality.

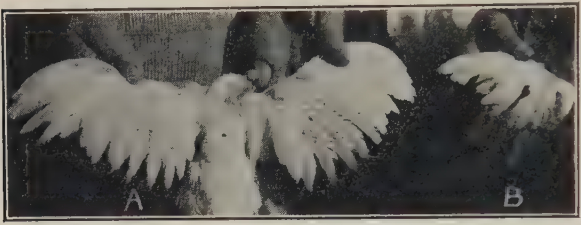


Fig. 36.—Growing Good Plumage Requires High Vitality.

The fact that the wing and tail feathers appear to grow out of proportion to the size of the body does not indicate that the feathers grow rapidly—the contrary is true. It indicates that the body has failed to grow; hence the wing and tail feathers, although they grow slowly, are out of proportion to the size of the body as compared to vigorous chickens of the same age and variety. The wings of the high vitality chicks would be in proportion to the body and very much larger than those of chickens having low vitality.

Condition of the Oil Gland

At the rear extremity of the back just in front of the tail, is an oil gland which supplies oil for the plumage. This may be used as an indication of constitutional vigor. A bird of high vitality is likely to have the gland full of oil, which gives to the feathers a shiny, glossy and brilliant appearance. The oil gland contains fat in the form of oil, which is stored energy. The bird lacking vitality usually has little or no oil, or surplus energy, to store in the oil gland, and the result is a dry, brittle and hence, ragged, dull plumage. A healthy bird plumes itself. Beware of the loose, rough plumaged bird as regards both production and vitality. The plumage may be broken and soiled due to wear but it should fit close to the body.

In the case of colored or parti-colored birds, those of high vitality produce more color pigment than those of low vitality; hence the most brilliantly colored plumage can be found only on birds having high vitality and good health.

The length of feathers and the number of feathers is also an important consideration. If we compare fowls of high with those of low vitality we will find that in proportion to their normal weight the birds of high vitality have more abundant plumage. This means more feathers and larger feathers. (Fig. 36.) A fowl to have the best plumage must be in the best condition of health.

Carriage of Tail and Wings

The way a fowl carries its tail and wing feathers is a valuable indication of health. The high vitality bird carries its tail feathers erect in the normal position for that variety. If the bird loses vitality the muscles controlling the tail or wings weaken and they droop. (Figs. 23 and 29.) The tail feathers go to one side, which produces " wry tail," owing to the loss of muscular power in the rump. A weak chicken relaxes all of the muscles. This shows in the attitude or posture of all parts of the body but more particularly in the wings and tail.

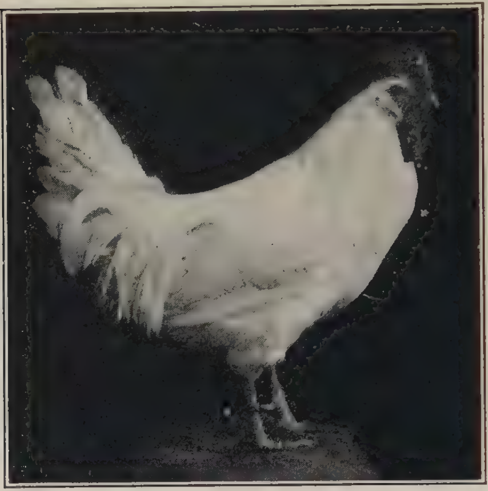
Fear also affects the carriage of the tail and wings. Courage and vitality go together. One of the best ways to pick males of high vitality is to put them with the weaker ones. Just as soon as the bird of lower vitality comes into the presence of the bird of higher vitality each knows very soon, frequently even before a test of strength, which is the better individual. After a male once finds that another male is his superior physically, he is filled with fear and shows this by drooping the tail and the wing feathers. He crouches down with fear while the superior male is erect, defiant, courageous, confident and ready to assert his physical superiority. He dominates the situation. The courageous bird holds the wing feathers close to the body and carries the tail in the normal, upright position of the variety. (Fig. 29.)

AGE AS A FACTOR IN JUDGING FOR CONSTITUTIONAL VIGOR

The element of age as influencing vitality must be considered relatively to other birds within the same age limits. Occasionally males several years old retain their vigor and hence are able to maintain their authority in the fierce competition with the younger birds. In the main, however, other conditions being essentially equal, the younger birds possess the greatest, potential, recuperative power.

Figs. 37 and 38 show some of the characters indicating the age of males. It will be seen by contrasting the two birds, that the spurs are longer, the shanks larger, the comb larger and more coarse, the wattles and earlobes heavier, and it will be found by handling that the keel bone is harder, in case of the older bird. The voice is often somewhat heavier in the older male.

The action is usually slower in the older bird, and the frequency of mating is less. There is no character except that of the spurs that does not have conspicuous exceptions. Frequently old males hold their young qualities to such an extent that it is difficult to distinguish them from younger birds. This is true also of frequency of mating. The contrast between the old and the young, male and female, can best be recognized in the fall before the birds have molted when the condition of the plumage and pigment color of skin shows the greatest contrast due to age.



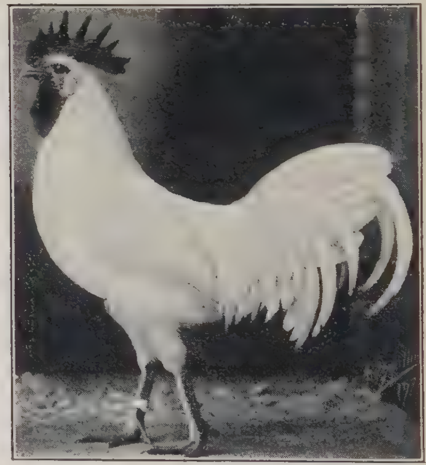
Courtesy Iowa State College.

FIG. 37.—Old Age Vigor Is the Best Proof of Natural Vitality.

This bird was seven years of age when the photograph was taken. Weight, 6⅞ lb.

HOW TO DISTINGUISH BETWEEN PERMANENT AND TEMPORARY LOSS IN VITALITY

One of the difficult problems in judging for constitutional vigor is to distinguish between permanent and temporary physical condition. Fig. 39 shows a bird which has evidences of a break in vitality of a high producing hen, as indicated by a slight neck molt, sunken face and eye, and the "limp" condition of the comb. This bird laid intensively until she had produced 240 eggs before reaching her limit. Following a period of recuperation these physical conditions indicating



Courtesy Homestead Poultry Farm.

FIG. 38.—Contrast the Clean-cut Appearance and Active Disposition of This Cockerel with the Cock Shown in Fig. 37.

a temporary decline in vitality, might normally be expected to disappear and be replaced by physical changes indicating a resumption of physical vigor, normal to the individual at her best.

Usually birds must be judged on their merits at the time of observation, without knowledge of their past. It is necessary, then, to decide if their high or low vitality is chronic, that is, permanent, or merely a temporary condition. Where the trapnest records are available and reveal past performance it is much easier to arrive at a correct decision. By permanent and chronic weakness is meant a constitutional condition that may have been either inherited or acquired but is not likely to change materially. On the other hand birds may be seriously, although temporarily, out of condition because of disease, parasites, or improper feeding or management, or because of excessive production, and yet wholly recover a few weeks later. The question to decide when examining such birds is whether the apparent weakness is permanent or temporary. The decision whether to discard a bird as unworthy must depend upon a balancing of its plus factors against its negative factors, and thus letting one offset the other. The importance of the faults or virtues is largely a matter of degree. They are quantitative. The focal point to be decided after balancing the factors for and against the bird's potential vigor is to estimate its apparent power of recuperation. Here the latent energy is most accurately expressed in the brightness and fullness of the eye, the weight of the body, being neither over fat nor decidedly under weight, and the unmistakable evidences of quick recovery from molt are important deciding factors.

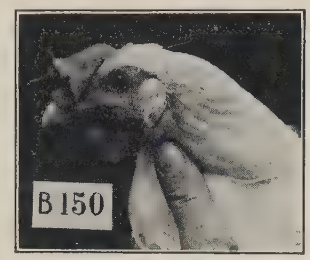


Fig. 39.—Vitality Is a Variable.

It may be either permanent or temporary. This bird was temporarily out of condition.

CHAPTER IV

PHYSIOLOGY OF EGG PRODUCTION

Egg production in the domestic fowl is reproduction. Each normal fertilized egg contains every essential for the maintenance of life and the development of a normal embryo during a period of twenty-one days. Each time a hen lays a fertile egg she supplies the potential substance necessary for a new individual. The fact that hens will produce eggs without being fertilized by the male, in large or small numbers, depending upon their breeding and management, is the basis of the commercial production of eggs for human consumption. If a hen ceased production when she had laid the one or two clutches which it was natural for her to do in the wild state there would be no commercial egg industry.

In our method of judging birds for production by external characters, it is necessary to arrive at a conclusion concerning the condition, and present or past activity of the internal organs of the bird being judged. This is made possible by the many significant relationships which have been found to exist between external characters and the internal organs, especially the reproductive organs. A thorough knowledge of the physiology of reproduction is necessary, therefore, to interpret intelligently the reproductive condition and the reproductive ability of an individual by the use of external characters. See Chapter VIII.

THE FEMALE REPRODUCTIVE ORGANS

The egg-producing organs of the domestic fowl, the ovary and oviduct, Fig. 40, are located in the upper rear part of the body cavity. It is in these organs that the egg structure shown in Fig. 41 is completed. The yolk of the egg is the first part to develop. This process takes place in the ovary, which is situated at the left of the median line of the body, just back of the lungs and below the forward extremity of the left kidney. In early embryonic life there are two ovaries. Normally only the left one develops. The functioning ovary appears as a cluster of many yellow or reddish-yellow spheres which vary in size from that of the normal yolk down to those which are so small that they are not visible to the unaided eye. The ovary contains many hundreds of these minute yolks. (Fig. 40.)

The ovary and oviduct of a hen in full laying condition are shown in Fig. 42*a*, and those of a hen in dormant condition in Fig. 42*b*. The development and consequent changes which take place in the ovary and oviduct of a hen are shown in Fig. 43. Each yolk is joined to the main stalk of the ovary by a stalk of its own, called a follicle. A continuation of the follicle surrounds the yolk as long as it remains connected with the ovary. If a normal fowl is killed while in laying condition, the yolks are found in all stages of development. (Fig. 40.)

When the yolk becomes mature, the funnel-shaped opening of the oviduct rises and envelops the yolk sac or follicle. The yolk sac then breaks along the suture line and allows the yolk inclosed in its vitelline membrane to escape and begin its passage through the oviduct. If the egg is to be fertilized, the fertilization occurs just after the yolk has entered the oviduct and before any of the albumen is deposited. As soon as the yolk escapes from the follicle, the sac contracts and usually remains as unabsorbed tissue. Some investigators have found that the approximate number of eggs produced by a fowl can roughly be determined by counting the number of empty yolk sacs in the ovary.

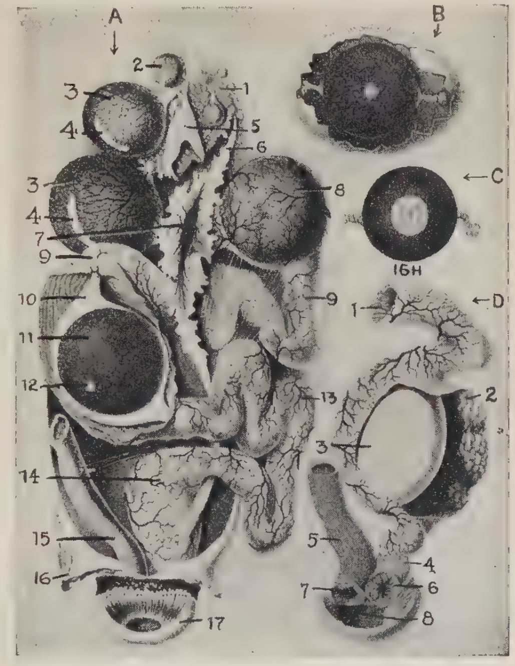


Fig. 40. —Oviduct of a Laying Hen.

1, ovary, with minute ovules; 2–3, yolk sacs; 4, suture line; 5, empty yolk sac; 7, funnel opening into oviduct; 8, yolk in oviduct; 9, albumen-secreting region; 10, albumen being secreted; 11, yolk passing through oviduct; 12, germinal disk; 13, isthmus; 14, uterus; 15, large intestine; 17, cloaca. On the right-hand side of the figure are shown, from the top downward: complete egg; yolk of egg incubated for sixteen hours; completed egg in uterus—(1) isthmus, (2) glands of uterus, (3) complete egg, (4) vagina, (8) cloaca. (From Duval.)

Pearl (1912) removed the ovaries from thirteen hens and made counts of the ova (immature yolks) and ruptured follicles visible to the unaided eye. It was found that they varied in number from 914 to 3605. Including these with further counts in ovaries of chickens, water-fowl and certain wild birds, Pearl and Schoppe (1921) found that "In general the mean number of visible oocytes of different kinds of birds reflects the normal fecundity of laying activity of the same kinds of birds."

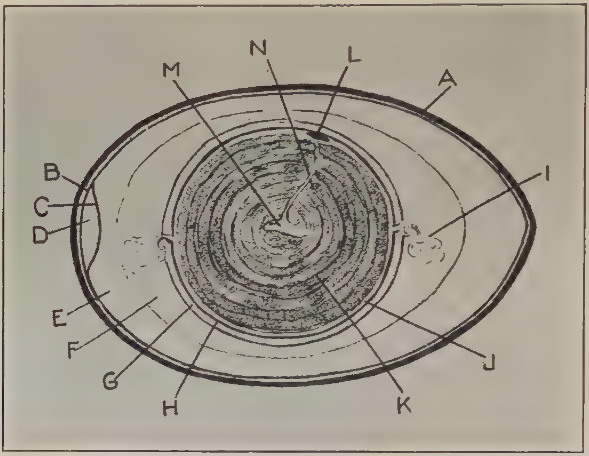


FIG. 41.—Structure of an Egg.

A, shell; *B*, outer shell membrane; *C*, inner shell membrane; *D*, air cell; *E*, outer thin portion of albumen; *F*, middle jelly-like portion of albumen; *G*, inner dense portion of albumen; *H*, vitelline membrane; *I*, chalaza; *J*, thin film of white yolk inside of vitelline membrane; *K*, layers of yellow yolk separated by thin layers of white yolk; *L*, germinal disk; *M*, central part of yolk filled with white yolk; *N*, slender tube connecting center of yolk with region of germinal disk.

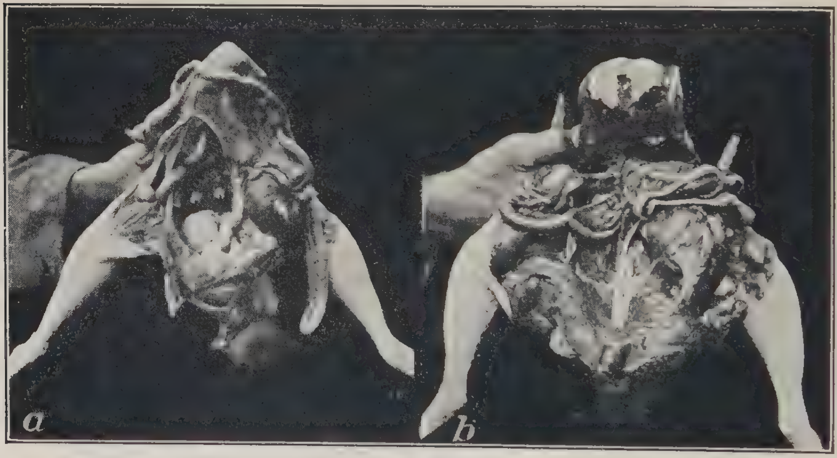


FIG. 42.—The Internal Organs of a Hen.

a. The internal organs of a hen in laying condition. The reproductive organs are large in size. An egg in the lower part of the oviduct may be seen.

b. The internal organs of a hen in dormant condition. The reproductive organs are very small in size.

Associated with the ovary is the oviduct. Curtis (1910) has described the oviduct of the laying hen as being " a large, much-coiled tube filling a large part of the left half of the abdominal cavity. It is suspended from the dorsal or upper body wall and lies dorsal to the adominal air sac. Its anterior end is expanded into a large funnel which is spread out beneath the ovary in such a way that the mouth of the tube faces the ovary."

According to Surface (1912), " The oviduct of a hen consists of five more or less clearly delimited regions. Beginning at the anterior end of the duct, these are ordinarily designated as (1) the funnel, (2) the albumen-secreting portion, (3) the isthmus, (4) the uterus or shell-gland secreting portion and (5) the vagina." (See Fig. 40.)

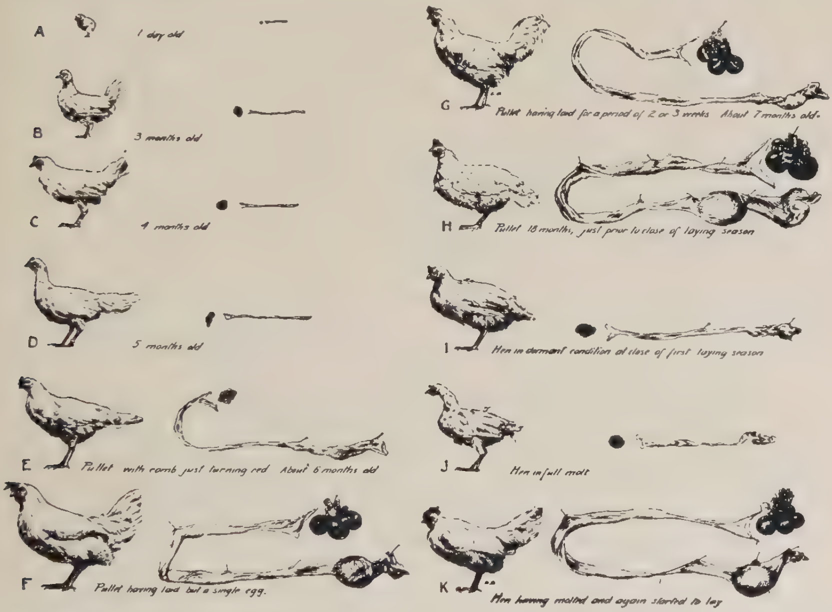

A
1 day old
B
3 months old
C
4 months old
D
5 months old
E
Pullet with comb just turning red About 6 months old
F
Pullet having laid but a single egg.
G
Pullet having laid for a period of 2 or 3 weeks About 7 months old.
H
Pullet 18 months, just prior to close of laying season
I
Hen in dormant condition at close of first laying season
J
Hen in full molt
K
Hen having molted and again started to lay

FIG. 43.—The Development of the Ovary and Oviduct of a Bird from a Day Old Chick to Sexual Maturity.

A to *F*, *G* and *H* show the actively functioning organs at different times during the year. *I* and *J* show stages of dormancy at the end of the first laying year. *K* shows the organs of a bird in production again after a period of rest.

FORMATION OF THE EGG

The yolk when ovulated moves through the neck of the funnel-shaped mouth of the oviduct into the albumen secreting portion. About forty per cent of the white, or albumen, of an egg is said to be deposited around the yolk as it passes down through the upper half of the oviduct. The albumen deposited at this time probably represents the two dense layers of albumen and the chalazae. (Fig. 40.)

After the yolk has passed this albumen-forming region, it passes into the isthmus, where the shell membranes are added, with ten to twenty per cent more albumen. By this time the egg is beginning to assume its final size and shape, and it now passes into the uterus, where the remainder of the albumen, about forty per cent, is added by passing through the shell membranes because of osmotic pressure and the shell is formed. The egg then passes to the vagina, where some of the shell pigment and the outer gelatinous coating of the shell are probably added. The egg is then ready for explusion from the body, through the cloaca.

Various sets of glands are located on the oviduct wall. These glands excrete their substance when irritated by the approach of the incompleted egg through the oviduct.

The shape of an egg is probably determined by many influences. According to Curtis (1914), " The shape of the egg is almost certainly due to the interaction of the two layers of muscle fibers in the oviduct walls." Curtis states further, " 1. The eggs of different individuals of the same strain vary in size, shape, color and markings. 2. The eggs of an individual are more like each other than they are like the eggs of other individuals of the same strain. 3. In spite of this resemblance between the eggs of the individual they nevertheless show a certain degree of variation in all their characters. 4. The first eggs laid by pullets are smaller than those laid by the same birds later."

THE STRUCTURE OF A NORMAL EGG

The structure resulting from the processes just described is shown in Fig. 41. The yolk is gradually developed in the yolk sac by the addition of concentric layers of yellow yolk around an inner vesicle of white yolk. According to Lillie, the yellow yolk is laid on daily in regular layers, separated by very thin strata of the white yolk. As the yellow yolk is laid on, the germinal disk moves gradually outward, always remaining close to the vitelline membrane. This moving disk leaves a path behind it, filled with white yolk, across which no yellow yolk is deposited. Rogers has found that about fourteen days are required for the full development of the yolk from its original minute size. The layers vary in thickness, as might be expected, probably owing to physical conditions of the bird, rate of laying and other factors. When the yolk is mature the germinal disk appears as a light-colored spot on the surface.

The first albumen to be deposited on the yolk is the very thin, dense layer, close to the vitelline membrane and continuous with the chalazae. The chalazae are attached at opposite sides of the yolk, extending out into the albumen toward the end of the egg. The size and position of the chalazae vary in different eggs. They may be twisted up close to the vitelline membrane or extended out into the thin albumen. A white, fibrous thread usually runs through the center of the chalazae, and this is surrounded by the dense, partially transparent albumen. In normal eggs the yolk is lighter than the albumen, and tends to rise and stick to the shell; in very stale eggs the yolk tends to sink. The chalazae act as a drag in either case, preventing any rapid change in the position of the yolk. The chalazae allow the yolk to spin on the longitudinal axis of the eggs; this allows the yolk to swing around so that the germinal disk is on the upper side, which is essential in order that the germ may receive the maximum amount of heat from the sitting hen or the incubator.

Next to the dense inner layer of albumen there is a thicker middle layer having somewhat less density. This layer varies in thickness and may be distinguished by its jelly-like appearance when the egg is opened into a dish. The third, or outer layer of albumen, next to the shell membranes, is very watery and transparent. The inner, outer, and middle layers make up the albumen, or white of the egg. Outside of the albumen are the inner and the outer shell membranes, which are added in the isthmus. These consist of a network of organic fibers. The inner membrane is of finer texture than the outer one, although the fibers in both are nearly transparent. The two membranes serve to protect the contents of the egg from outside sources of contamination.

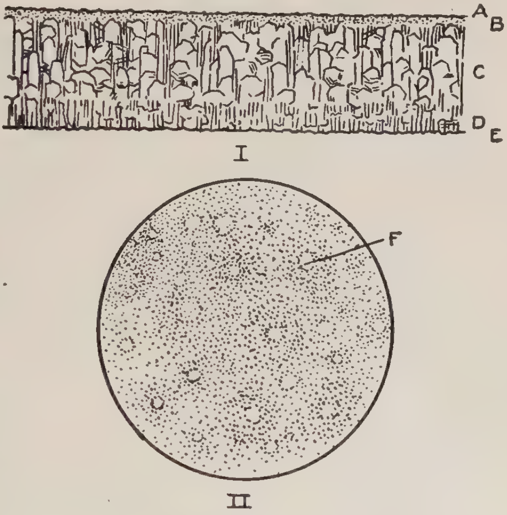


Fig. 44.—Shell Structure of an Egg (Highly Magnified).

I. Cross-section of eggshell: *A*, gelatinous coating over the shell; *B*, outer porous layer of shell; *C*, middle granular portion of shell; *D*, inner crystalline layer of shell; *E*, inner face of shell shown in II.

II. Inner face of eggshell: *F*, hexagonal section of crystal. This inner face shows the indefinite outlines of the crystalline structure of the inner layer of the shell.

The shell is a calcareous deposit added to the outer shell membrane in the uterus. The shell seems to consist of three layers as stated by Lillie. (Fig. 44.)

When the egg is first laid, it is completely filled; but as soon as it cools the contents contract and an air space is formed, usually between the two shell membranes and at the point where these easily divide. This air space usually forms at the large end of the egg, and is about one-half inch in diameter in the normal egg.

A part of the characteristic pigment and all of the bloom, or gelatinous coating, of the egg, is secreted in the vagina. This outside pigment may be removed with sandpaper or any similar abrasive substance. The gelantinous coating is easily dissolved by water or acids.

INTERNAL FACTORS AFFECTING THE INTERIOR QUALITY OF EGGS

When eggs are first laid they normally possess the characteristics of perfect fresh eggs, as have been described. There are, however, various abnormalities that may occur, and, since these abnormalities are usually detrimental to the quality of eggs, some of them will be described here.

General Conditions.—The physical condition of the bird probably has an effect on the quality of the egg. It is thought that the size and color of the yolk, percentage of moisture, condition of shell, firmness and amount of the albumen, and various other features, are affected by food, season of the year, condition of the bird, and the like.

Green food and yellow corn transmit a deep color to the yolk. Such food as white corn, buckwheat, and wheat, and such conditions as lack of exercise and poor health seem to produce a pale yolk. Any one of these factors may give distinct results. Excessive quantities of green food, such as rape in the early spring, sometimes have a disastrous effect on eggs, causing the yolks to be very dark in color and to possess an undesirable odor. Onions readily affect the odor and the flavor of eggs. Cabbage also does this to some extent, as do a few other foods.

Eggs produced during the summer seem to have a more watery albumen than those produced during the spring. Watery eggs are apparently of lower quality, and undesirable for cold storage or long holding. In candling such eggs, the yolks float lower in the albumen and appear slightly darker than in spring eggs.

Certain hens probably have an inherited tendency to produce eggs of inferior quality. If this is true it will be likely to remain as a characteristic of the line of descent, and the flocks must be carefully culled in order to eliminate such undesirable birds.

Ovarian Conditions. *Double-yolk Eggs.*—Detailed reports have been made by Glaser of double-yolk eggs resulting from the joining of two yolk sacs during their development. These sacs gradually develop one common blood supply. Their growth becomes identical or nearly so, and both yolks mature and drop into the oviduct at about the same time. It is supposed that two yolks may develop within the same yolk sac.

Multigerminal Disks.—Many yolks have more than one germinal disk, these showing as several round, light spots on the surface of the yolk. Only one of these disks usually shows development when an egg is incubated.

Misplaced Yolks.—Yolks are sometimes dropped into the oviduct before they are mature, and thus appear as abnormal yolks in the completed egg. Sometimes yolks are dropped outside the oviduct into the body cavity; they are then probably absorbed by the body tissues in most cases.

Blood Clots.—Perhaps the commonest of the faults arising in the ovary is the blood clot. This is usually caused by the rupture of a blood vessel when the yolk sac splits in order to allow the escape of the mature yolk into the oviduct. This rupture may be the result of such abnormal circumstances as a split occurring in some part of the yolk sac other than at the suture line, or a crossing of the suture line by a blood vessel. Ruptures of other tissues may have a similar effect. Blood clots seem to occur relatively oftener during the first laying period of pullets and during the spring period of heavy production than at other times. This is probably due to the extra heavy strain on the egg organs at these times.

The clot of blood adheres to the yolk as it passes through the oviduct and if it is of good size it may be distinctly seen when candling. A blood clot can be distinguished from other spots by its bright red color and by the fact that it is on the surface of the yolk and moves only with the yolk. A blood clot alone shows as a distinct spot through the shell, and not as a diffuse-colored area of the egg. When the egg is opened the clot can be distinctly seen. If it is removed, the egg is suitable for use as food unless otherwise defective. An ordinary blood clot does not color the albumen; if the albumen is colored, the egg is termed a bloody egg.

Because of the presence of blood in these eggs they are often confused with incubator eggs, and customers refuse to use them for any purpose. Hotel stewards require that all their eggs shall be candled for the purpose of eliminating the eggs with blood clots. The producer or dealer should make use of many of them and avoid the waste. It is believed that certain hens have a tendency to produce these clots, and by culling such birds from the flock the percentage of blood-clot eggs can be greatly reduced. Blood clots are probably detrimental to the keeping quality of eggs.

Oviduct Conditions. *Body-heated Eggs.*—An egg is forced through the oviduct by the peristaltic action of the muscles in the oviduct wall. Sometimes, apparently due to fright, this action ceases temporarily, and the egg is held in the body of the fowl for several days after it is completed. This keeps the egg at body temperature, and incubation begins. If the egg is fertile, the results are disastrous at once. If the egg is infertile, of course the results are not so serious and the egg may be fit for use when laid, depending on the extent to which the egg was infected while being held in the body of the hen.

Eggs within Eggs.—When an egg has passed through the oviduct and is ready to be laid, a reverse peristaltic action may be incited in some way, and the egg will be forced back up the oviduct until normal forces again push it along its regular course. In this way one yolk may be enveloped with two complete sets of albumen, shell membranes, and shells. Three sets have been known to be formed over a single yolk, probably in this way. Sometimes other yolks are met by the ascending egg and the whole is surrounded by one set of albumen, shell membranes, and shell. The first egg, in any case, is usually an abnormally small one, and this may often account for the reversal of the peristaltic forces.

Yolk Substitution.—Grains or fragments of other foreign substances may be forced up the oviduct from the cloaca. This has been known to occur, and during the normal return of such substances the oviduct glands have secreted albumen, shell membranes, and shell, forming a complete egg except that a foreign body has been substituted for the yolk.

Foreign Substances within Eggs.—Due to causes similar to those resulting in yolk substitution, grains and other foreign substances are sometimes found floating in the albumen. If an egg has previously been broken in the oviduct, the broken contents may gradually harden and cling to the oviduct wall. Later they may become detached and pass along with an egg. In this way various forms of dried yolk and albumen may be deposited in eggs; rings of dried yolk and albumen have been observed, as well as various other peculiar shapes.

Intestinal Worms within Eggs.—Intestinal worms are sometimes found in eggs. They apparently gain access to the oviduct from the large intestine and are later included in an egg as it is being formed. These worms vary in size and form, but are usually white in color.

Double-yolk and Connected Eggs.—If one yolk drops into the oviduct shortly after another, even though this is not due to an abnormal condition of the ovary, the one secretion of albumen may surround both yolks and form a double-yolk as previously described. A few cases of triple-yolk eggs, apparently formed in the same way, have also been described. If the yolks are too far apart to be inclosed as one egg, they may still remain connected in various ways. A small amount of albumen, with shell membranes and shell, may connect the two complete eggs. The two adjacent chalazae may be either continuous or separate. Sometimes only the shell membranes connect the eggs, neither albumen nor shell being present.

Soft-shell Eggs.—Eggs are sometimes produced having only a very thin shell or having no shell material at all. Eggs of this type are the result of a condition that may be caused by a lack of lime in the glands of the uterus or by one egg forcing the next egg out of the body of the fowl before the shell can be formed. Soft-shell eggs occur, therefore, most frequently during the period of heavy egg production.

Meat Spots.—Particles appearing like pieces of liver are often found floating in the albumen. On closer examination these particles seem to be pieces of the dead glands of the oviduct wall, and, since they occur very often, they are thought to be fragments of this waste tissue. In candling eggs it will be noted that meat spots appear very dark and float near the shell. They may be of various shapes or may consist of several very small, floating specks. They lack the characteristic red appearance of a blood clot, and are free from the yolk. When an egg having this peculiarity is broken open, the meat spot is sometimes found attached to one of the chalazae or it may float entirely free. If it is removed, the egg is satisfactory for use as food unless otherwise defective. Such eggs are treated on the market in the same manner as are those having blood clots.

Bloody Eggs.—The oviduct often becomes injured and irritated so that blood is exuded with the albumen, making the albumen appear distinctly bloody. This condition may appear throughout an egg or in certain parts of it, as already mentioned. Bloody eggs are more common with pullets just beginning to lay or during the heavy laying period than at other times, as in the case of blood clots, and are probably due largely to over-exertion of the oviduct. The blood in the albumen is often concentrated about the chalazae, but this is not always the case. Certain individuals of the flock are generally responsible for all the bloody eggs, and it is well to remove these fowls when they are discovered. It is usually impossible to remove the affected part of the albumen; therefore, the egg is useless. Because of this, bloody eggs are a more serious loss than those having blood clots or meat spots.

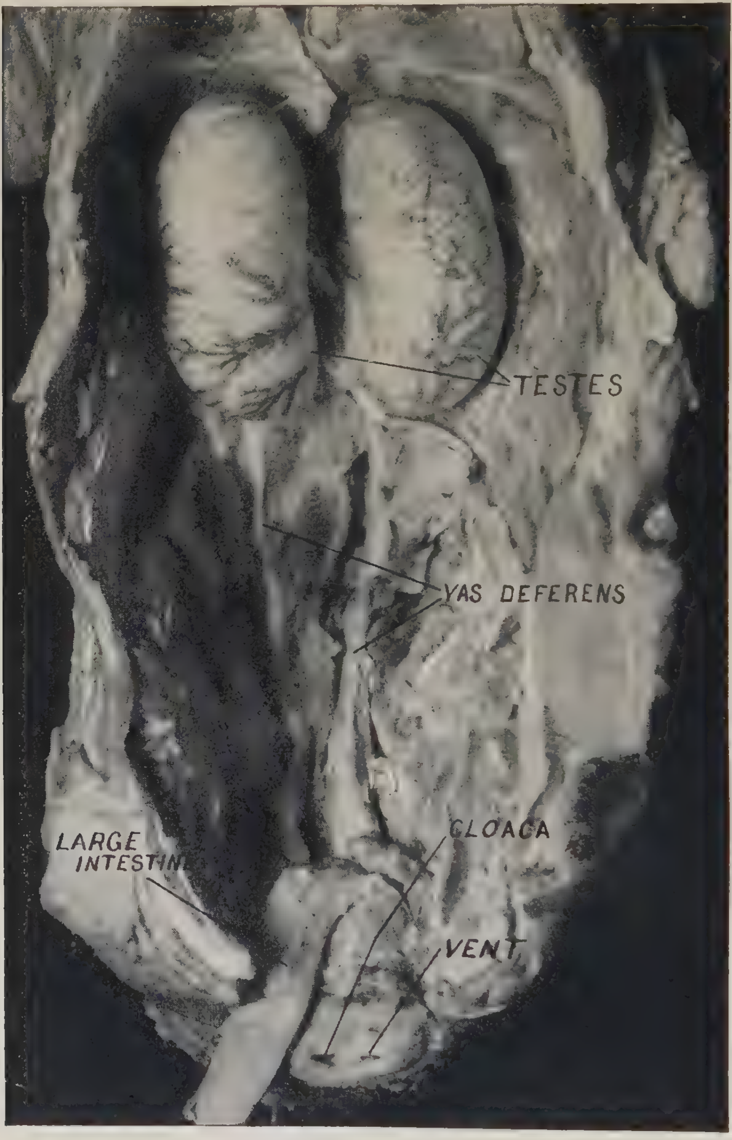

TESTES
VAS DEFERENS
CLOACA
VENT
LARGE INTESTINE

Fig. 45.—Male Reproductive System.

Loose-shell Membrane.—Sometimes fragments resembling parts of the shell membrane are found floating in the albumen. These are apparently due to slight secretions of the shell membrane glands in the isthmus, which have formed little fragments of membrane that cling to the walls of the isthmus. When the next egg passes through the oviduct, these membranous fragments are carried along and float free in the albumen. They are not detrimental to the quality of an egg, but eggs bearing them are usually discarded because of their suspicious appearance to persons not understanding the cause. The term " tapeworm " is a popular one given by egg candlers to this type of egg, because of its peculiar appearance.

THE REPRODUCTIVE ORGANS OF THE MALE

The reproductive system of the male consists of the testes and associated organs. The two testes are situated high up in the abdominal cavity, along the back, near the anterior ends of the kidneys. In form they are more or less ellipsoid, and in color light yellow. Frequently they have a reddish cast due to the numerous much-branched blood vessels on the surface. (Fig. 45.)

In structure the testis is composed of a large number of very small, slender ducts, from the linings of which the sperm are given off. These ducts, called seminiferous tubules, appear in groups separated by delicate membranes which extend inward from a membrane surrounding the organ. They all lead eventually to the vas deferens, a tube which ends in a small papilla (penis), which serves as an intromittent organ. The two papillae are located in the upper wall of the cloaca. The mature sperms pass down the vas deferens and are ejected through the papilla at the time of copulation.

As in the case of the female, any changes in the primary sex organs of the male are indicated by changes in the comb and wattles, the secondary sex characters.

CHAPTER V

PIGMENTATION AND ITS RELATION TO PRODUCTION

The Fundamentals.—The present chapter and discussion of pigment will be taken up from the standpoint of the reasons why pigment is an important character. This calls for a review of the work of several different investigators in order to show the close physiological relationship existing between egg production and the pigment taken into the body in the feed. This review should clear up many of the questions that might arise. It will be followed by a discussion of two theories advanced for the appearance and disappearance of the yellow pigment in the various parts of the body and will point out the limitations of each theory. Chapters XII and XIII will aid in presenting the practical application of this character to culling and the selection of layers and breeders.

Many Types of Pigment Colors.—Many different pigment colors are found in the shanks of the various standard varieties of chickens. Among the shank colors most commonly observed are: white, yellow, blue, black, green and red, in addition to different combinations of these. As far as their application to poultry judging work is concerned, the yellow shank color is the only one that is of special value because this is the only one that appears to be deposited in the fatty tissues of the body. All of the various shank colors are due to the presence of two pigment colors; orange-yellow and brownish-black. (Plate I.)

Yellow.—Barrows (1914) describes this as a lipochrome pigment, which, when present, is diffused through all parts of the cell. The shade of color will vary from a light lemon to a dark orange depending upon the concentration of the pigment in the cells. It is found in the epidermis and the fatty masses of, and beneath, the corium. The epidermis is the outer layer of the skin while the corium is the inner layer. The epidermis is subdivided into two parts: the rete of Malpighi and the stratum coreum, or horny layer. The corium is similar to the connective tissue in structure and is made up of strata corresponding to the rete and corneal layers of the outer skin.

Black-brown.—This dark color is carried in microscopic pigment granules which are scattered through the cells of the epidermis or located in special cells, usually in the corium.

COLOR PIGMENT IN THE EGG, THE BODY OF THE BIRD, AND THE FEED ARE CORRELATED

At the present time we have evidence from several different sources pointing out the close relationship between the yellow pigment found in the yolks of the hen's eggs and the xanthophyll pigments found in the green plants. C. A. Schenck (1904) first pointed out this relationship. Later two investigators, Willstätter and Escher (1911–12), isolated the pigment of 6000 hens' eggs in crystalline form and from its chemical constitution and properties believed it to be isomeric with the crystalline pigment, xanthophyll, of the chloroplasts of green plants.

Much in Common between the Pigments of Milk and Eggs

Likewise the natural yellow pigment that characterizes the milk fat, body fat, and blood serum of the cow is physiologically, as well as chemically, identical with the carotin of the chloroplasts, and depends upon the presence of this pigment in the food for its presence in the body tissues, fluids and secretions of the animal body. Rice (1889) reported that yolks laid by birds fed on a nitrogenous ration containing bran, shorts, cottonseed meal, linseed meal, skimmilk, green clover and cabbage were dark colored whereas yolks laid by birds fed on a carbonaceous ration consisting of corn, wheat, green clover and cabbage were a rich yellow color. Waite of the Maryland Agricultural Experiment Station (1911) pointed out by means of feeding trials the physiological relationship between the primary egg-yolk pigment and the xanthophylls of the feed. In one case yellow corn comprising about one-half the ration and fed as a scratch feed with a mash of bran, gluten meal and beef scrap was compared with a ration in which the yellow corn was replaced by whole wheat and in another case with equal parts of yellow corn and whole wheat. All the eggs from the lot receiving yellow corn showed yolks with deep yellow color; those from the lot receiving corn and wheat showed yolks with a fair yellow color; while the eggs from the wheat-fed lot had yolks noticeably very pale colored. The simplest explanation of this result was found in the fact that yellow corn is very rich in xanthophyll.

HOW THE YELLOW PIGMENT GETS INTO THE EGG

With a view of furnishing definite experimental evidence of a physiological relation between the plant pigments, xanthophyll and carotin, and the natural egg-yolk pigment, Palmer of the University of Missouri carried out the following experiments. Three different rations were fed; one containing a large amount of xanthophyll, another small amounts of xanthophyll and large amounts of carotin, and the third one containing neither pigment to any degree. The birds at the beginning of the experiment had pale yellow shanks and beaks and white earlobes.

The yolks of the raw eggs were examined by separating them from the albumen and spreading the raw yolks upon a porcelain crucible cover. The eggs were examined until no further change in the color of the yolk was apparent. Then the birds were killed and studies made as follows:

(1) Amount of pigment carried in the blood serum of each group.
(2) The character of the pigment present—xanthophyll or carotin.
(3) The way in which the pigment was carried in the bloodstream.

A study of the results showed that it required but a few days of feeding the pigment-free ration to reduce the yolk color to its lowest color obtainable on that ration. In case of the xanthophyll ration a very noticeable increase in color was noted on the second day after the change from the preliminary ration to the xanthophyll ration. The hens did not eat enough of the scratch feed with its high xanthophyll content and the yolk color was gradually reduced. A change in the feeding practice causing a greater consumption of the xanthophyll pigment resulted in an increased yellow color of the yolks of the eggs laid by those hens getting the xanthophyll ration. The results obtained with the carotin-fed hens were similar to those obtained with the pigment-free ration. Even when carrots, which are heavy carriers of carotin, were added to the ration there was no appreciable color change in the yolks. A removal of the bran in the " pigment-free " ration further reduced the yolk color of the eggs laid by the birds receiving that ration.

The examination of the blood of the hens fed on the pigment-free ration showed no perceptible color. Likewise the blood of the carotin-fed hens showed little yellow color. The blood serum of the xanthophyll-fed hens showed large quantities of the yellow pigment in the blood. The pigment showing in these tests was found to be practically all xanthophyll with but small amounts of carotin present.

The xanthophyll was found to be carried by the fat of the blood. This is different from the method of transportation of the carotin pigment in the cow. There it was found that the pigment was carried by the water-soluble compound of the albumen of the serum.

A study of the body fat of the birds in the different lots showed that the fat contained both pigments, but the xanthophyll in much greater proportion. In the case of the cow the reverse condition was found to exist. There was a slight difference but not enough to be of any significance between the average color of the fat of the xanthophyll-fed lot and the pigment-free lot. There was no appreciable change in the pigment color of the beaks or shanks in any of the three lots. The xanthophyll ration probably did not increase the color of the shanks due to the fact that the ration did not cause a deposition of fat in the lower epidermal layers of the skin. The length of the experiment was undoubtedly too short to get a noticeable change in the color of the shanks of the pigment-free-fed lot.

This study revealed: first, that the hens utilize relatively little carotin in the pigmentation of the egg yolks and body fat, the principal pigment used belonging to the xanthophyll group of plant pigments; second, that the egg-yolk color could be changed very quickly by changing the xanthophyll content of the laying ration; third, that the yellow pigment is carried in the fat bodies of the blood and is presumably transported in this manner from the intestines to the ovaries.

A brief review of work done by different workers on the behavior of fat-soluble dyes when they are placed in the animal body may throw some light on the path which these yellow pigment particles take in reaching the egg yolks.

In 1908 Gage and Gage reported that a color dye known as Sudan III could be transferred from the yolk fat to the body of the young chick. Rogers (1912), Mendel and Daniels (1912) and others have added much to our knowledge of the redistribution of pigment by feeding different color dyes which will stain the fat particles in the bird. Mendel and Daniels (1912) fed several different animals the fat-soluble dye known as Sudan III. The fat is absorbed by fowls very readily and hence in a short time the fatty tissues of the fowl's body showed the red staining of the Sudan III. The largest quantity of stained fat was found in the subcutaneous tissue, the fatty tissues of the abdominal cavity, and the bone marrow. The renal and nervous tissues were free from the stains of the fat-soluble dyes. Staining of the liver was seldom found, because the fat-soluble dyes, which are insoluble in water, dissolve readily in the bile and are thereby excreted into the intestine from which point they can be reabsorbed. They found that the fat-soluble dyes may enter the organism from the alimentary tract through the lymphatics, in solution in fat or by the portal circulation, dissolved in reabsorbed bile. They do not pass beyond the liver unless fat is present to transport them. They may be found in the blood, which is rarely free from the dye in a normal fed animal that has once been stained. Thus a cycle between the intestine, bile and blood becomes established.

Whether the yellow pigment acts in the same way that a fat-soluble dye behaves is not definitely known. Inasmuch as the yellow pigment, xanthophyll, is a fat-soluble compound it is reasonable to suppose that it reaches the egg yolks in a manner quite similar to the way in which the Sudan III reached the egg yolks. Also, the fact that carotin is a water-soluble compound may explain the reason why that pigment is not utilized by the fowl. The fact remains, however, that the fowl does utilize the pigment, xanthophyll, in the formation of the egg yolks, drawing this pigment from the feed taken into the body.

TWO HYPOTHESES ACCOUNTING FOR BLEACHING OF PIGMENT

The question that has puzzled scientists for many years, and is still an unsettled one insofar as most investigators are concerned, is not the way in which the pigment gets to the egg yolks from the feed, but instead the reason why the pigment disappears from the visible parts of the bodies of the yellow-skinned breeds coincident with a long period of egg production. Two different hypotheses have been advanced by investigators to account for this so-called bleaching of the shanks and other visible parts of the body. The one hypothesis which was originally advanced by an anonymous writer in 1914 and which was adopted by Blakeslee and Warner (1915), in explanation of the relationship which had been observed to exist between fecundity and pigmentation, is that the growth of the egg abstracts the pigments from the body tissues, thus causing the bleaching of the various parts of the body. If such were the case we would expect to find that birds laying at a heavy rate of production bleach much more rapidly than do birds laying at a lower rate. Likewise, we would expect to find that birds fed on a pigment-free ration would continue to give deep yellow colored yolks for considerable time after they were changed from a xanthophyll ration to the pigment-free ration if they still carried considerable amount of pigment in the body fat at the time that they were laying those eggs.

A close study of this hypothesis brings out several points that are not entirely consistent. For example, birds kept under environmental conditions where the amount of green food or other feeds containing large amounts of the pigment, xanthophyll, are not present will gradually lose the color present in the shanks and beak even though the birds are not laying. Likewise, as pointed out in the review of the work done by Palmer (1915), in feeding birds rations containing the plant pigments in varying amounts and kinds, those hens which were placed on the pigment-free ration and to a slightly less extent those birds on the carotin ration began to lay eggs within a few days that failed to carry the normal amount of yellow color in their yolks. If it were possible for the pigment stored in the fatty tissues of the body to be incorporated in the egg yolks of the eggs being manufactured at that particular time, we would not expect a sudden drop in color of the yolks produced by birds fed on the pigment-free ration. Instead we might reasonably expect that the yolk color would become lighter and lighter in shade as the color was drawn from the stored-up fat, finally becoming as light in color as it was possible to obtain them only after all of the yellow color had disappeared from the beak and shanks of the birds. Palmer in his work failed to find this natural expectation to be true because the bird on the pigment-free ration laid eggs within a few days that were nearly as light in color as they ever became at any time during the experiment, yet there had been little change in the shank color of the birds laying the eggs.

As a result of these experiments Palmer and Kempster were led to adopt an entirely different hypothesis. They believed that the fading of the yellow pigment in the visible skin parts in such breeds as the Leghorns, as a result of fecundity, was not due to an abstraction of the pigmented fat from those parts and the subsequent incorporation in the egg yolks, but instead the normal appearance of the yellow pigment in the beak, shanks and other parts of the body of the yellow-skinned breeds was the result of the natural secretion of the yellow pigment in the digestion process. They believed that when a supply of pigment in the feed was used up by fecundity the pigment already present in the skin was gradually excreted through the outer epidermis and became oxidized by contact with the air or else wore away as the result of normal structural changes taking place in the epidermis of the skin. They have carried on experimental work that adds considerable support to such a hypothesis. This work will now be briefly reviewed.

In order to demonstrate that the removal of the supply of xanthophyll in the ration would cause a reduction in the amount of pigment present in visible parts of the body, even when fecundity would have no effect on this reduction, they took two cockerels that had been reared on a carotinoid, free ration and were bleached absolutely white in the visible parts of the body, and fattened them for 16 days on a ration of white corn and milk. At the end of this period the white corn was changed to yellow corn. By the fifth day yellow color began to appear and by the forty-second day the visible parts of the body and even the plumage had become very highly pigmented. These birds were then again placed upon the white corn ration and at the end of 90 days the vent, eyering, earlobes and beak were entirely bleached white and a noticeable bleaching had taken place in the shanks of the birds. After 200 days of this ration the yellow color had disappeared entirely except for a small amount in the coarse scales of the shanks. By taking frozen sections of the skin from time to time from these birds it was found that the xanthophyll gradually faded first from the corium, then the pigment disappeared from the outer layer of epidermis which extended into the rete of Malpighi, and lastly the xanthophyll at the base of the Malpighian layer was bleached out.

They demonstrated that the pigment of the fatty tissue of the birds that are slowly fading in color is not related to the disappearance of pigment from the skin by the fact that the fatty tissues still retain their normal yellow color after the visible skin parts of the body are entirely bleached white.

They also placed several laying hens that, since the time of hatching had been fed on a carotinoid-free ration, on a ration containing a very good supply of xanthophyll. Eggs from these hens showed very deeply colored yolks, but there was no evidence of pigment in the visible skin parts of the body as long as production occurred. Neither was there any evidence of an increase in the amount of yellow color in the fatty tissues of the body until after production had ceased. The normal yellowing up of the fatty tissues and the visible skin parts occurred as soon as egg production ceased. This would indicate that in most birds as long as production continues there is no surplus of the xanthophyll pigment going to the fatty tissues of the skin, but that all of it is utilized in the formation of the egg yolks.

In summary of this work we may say that in order to start bleaching all that is necessary is to remove the source of the pigment in the ration or else direct it to the egg yolks. When the pigment is deposited in the various parts of the body it is in granular form rather than dissolved in the fat. It is usually located in the Malpighian layer of the epidermis with little fat present, but when it is located where considerable fat is present it is dissolved in the fat. Finally, evidence is presented which indicates that the pigment already in the body leaves the body by means of excretion through the skin rather than through the channel of the egg yolks.

The reason advanced for the fact that certain parts of the body bleached so much more rapidly than did others was that the circulation of blood was more rapid in certain parts of the body than in others and hence more rapid bleaching occurred. This, of course, would explain it if the first theory discussed by Blakeslee and Warner was accepted, but it does not explain it under the conditions of the second hypothesis by Palmer and Kempster. However, it is reasonable to suppose that certain parts of the body will bleach more rapidly than others because the skin is so much thinner in some places than others. This, then, may account for the vent, eyering and earlobes bleaching within a short time while it requires several weeks or months for the beak and shanks to bleach. It would seem that the only possible explanation for the base of the beak bleaching before the tip of the beak, is that the beak at the tip is made up of harder material and hence the color cannot readily disappear.

The Pigment Content of Various Feeds.—As already suggested in this chapter, we find that certain feeds are heavy carriers of the xanthophyll pigment whereas other feeds are very light carriers or else are entirely free of this pigment. Work carried on by Palmer and Kempster indicates that yellow corn and green plants are the only heavy carriers of the xanthophyll pigment. Hemp seed, barley, gluten feed and red corn were found to contain a small amount of this pigment, but wheat, wheat bran, white corn, oats, cottonseed meal, rape seed, meat scrap and blood meal were found to contain negligible quantities of xanthophyll.

It may be seen from this list of feeds that it is difficult to produce eggs carrying very light colored yolks and at the same time obtain those eggs at a cost comparable to what the cost would be if a ration containing these highly pigmented feeds were fed. Usually yellow corn is about as cheap a poultry feed as can be bought when the vitamin content of the feed as well as the nutrient value are considered, and hence if this feed had to be replaced by a more expensive feed the cost of egg production would be increased. In many sections of the country white corn is not obtainable and the amount of oats or buckwheat that may be included in the ration is limited by their high fiber content, hence wheat usually is the most economical grain for producing light-colored yolks.

The yellow pigment is visible in all parts of the body of yellow-skinned varieties (Table 1 shows the combinations of beak and shank color in both yellow and white-skinned birds) where the plumage or other colors do not interfere. On deeply pigmented birds the yellow color is very easily seen in the beak, shanks, and in the ring of tissue around the eye. The color also shows clearly in the tissues around the vent of all yellow-skinned breeds and in the earlobes of all the white earlobed varieties. It is not visible in the earlobes of the red earlobed varieties except in cases where the red may look a yellowish red rather than a

TABLE 1

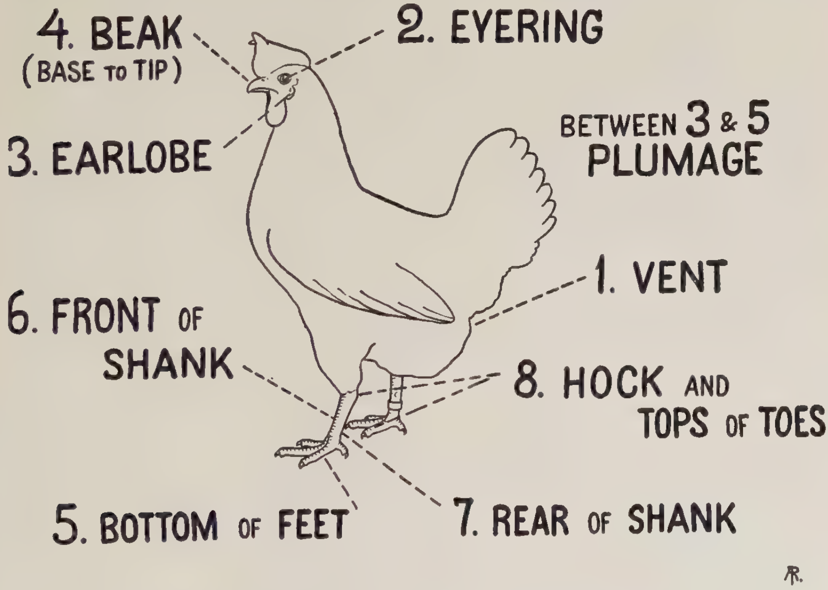
Combinations of Beak Color and Shank Color Found with Different Skin Colors and the Common Breeds and Varieties Showing each Combination

Skin	Beak	Shank	Breeds and Varieties
Yellow	Yellow	Yellow	White, Buff, and Black Wyandottes White, Barred and Buff Plymouth Rocks Rhode Island Whites Chantecler White and Black Cochins White, Buff, and Black Leghorns White and Dark Cornish
	Dusky Yellow	Yellow or dusky yellow	Silver Penciled Rocks Silver Penciled Wyandottes Dark Brahmas
	Horn	Yellow	Blue Plymouth Rocks
		Yellow or leaden-blue	Mottled Java
	Dark Horn	Yellow or dusky yellow	Partridge Plymouth Rocks Partridge Wyandottes Silver and Golden Laced Wyandottes Partridge Cochins
	Yellow—dark stripe on upper mandible	Yellow	Columbian Plymouth Rocks Columbian Wyandottes Light Brahmas Buff Brahmas
	Black	Black—yellow on bottoms of feet	Black Java Black Jersey Giants Black Cochin
	Reddish Horn	Yellow or reddish horn	Rhode Island Reds
	Yellow shaded with yellow horn	Yellow	Buckeye
	Yellow—upper mandible shaded with black	Yellow or mottled with black	Ancona
White	White	White	White Dorkings
	White streaked with horn	White	Silver-gray Dorking
	White or light horn	White or pinkish white	Buff Minorca Silver and Golden Campine
	Pinkish white	Pinkish white	White Minorca White and Buff Orpingtons
	Horn	White	Red and Speckled Sussex
		Leaden Blue	Blue Orpington Blue Andulusian Redcap
	Dark Horn	White	Colored Dorking
		Bluish black—web and toes pinkish white	Black Langshan
	Light Slate Blue	Slaty blue	White Langshan
	Black	Black	White-faced Black Spanish
		Black or dark slate	Black Minorca
		Black—toes pinkisk white	Black Orphington

bright red. In birds that are highly pigmented the comb and wattles will have a distinct yellowish-red cast. The color is hard to see in the beaks of a few breeds such as the Rhode Island Red due to the reddish horn color present in the beaks of these breeds. Also such breeds as the Barred Rocks may have dark spots on the shanks, giving them a mottled appearance, or the shanks may be a yellowish black as in the Black Jersey Giants. (Plate 2.)

THE PRACTICAL APPLICATIONS

The Order of Bleaching.—The word " bleaching " is used to designate the process of disappearance of pigment due to oxidation and excitation of tissues and not merely to the action of light. The one thing that makes pigment so valuable in estimating how long a bird has or has not laid is that the pigment disappears in a regular order from the various parts of the body. (Fig. 46.) This same order seems to be very uniform in all birds even though the rate of the disappearance is not always the same. Hence we have a very accurate measure of continuous production for the few weeks prior to the time when the bird is examined.



Courtesy Poultry Department, Cornell University.

FIG. 46.—Pigment as a Factor in Judging Poultry.

This shows the order of disappearance of pigment. The order of return of the pigment is essentially the same.

The following order seems to hold for all yellow-skinned breeds: first the vent, closely followed by the eyering and earlobe, and then the beak, starting at the base and gradually extending to the tip of the beak, and lastly the shanks. In case of the bleaching of the shanks and feet we find that the bottoms of the feet will lose the yellow color more quickly than the shanks. The fronts of the shanks bleach out more quickly than the backs of the shanks, the toes or the hocks, but not as quickly as the bottoms of the feet. The hock joints and the rough scales along the tops of the toes and particularly at the point where the toes are attached to the shank itself, are the last parts of the shank to lose the yellow color.

It is sometimes assumed that the beak becomes entirely white or pale in color before any bleaching takes place in the shanks. This is not entirely accurate because the color begins to disappear from all parts of the shank at the same time, but due to the difference in the texture of the skin or scales in the various parts of the body one part will become entirely bleached while another part will barely show the effects of the bleaching. In work carried on at the Cornell University Agricultural Experiment Station it was found that the bottoms of the feet and the front of the shanks would show the effects of bleaching very noticeably by the time the beak had become entirely bleached. There was no noticeable change in the color of the hocks or the backs of the shanks during that period of time.

Experimental work, studying the time required for the different parts of the shanks to become entirely bleached, indicates that there is a wide range between the different birds of a flock. We would expect also a wide range between flocks due to a difference in the environmental conditions under which those flocks are kept. As a result it seems desirable to give the extremes that have been noted in the experimental work as well as the average time required for bleaching of the various parts of the body. The following figures are the results of observation made by Palmer and Marble on a group of 111 S. C. White Leghorns at Cornell University during 1924–1925. In these observations the degree of pigment was recorded as 1, 2, 3, 4 or 5, depending on its intensity. No birds are included in these averages that had laid previous to the first examination, or that lacked a good, deep yellow color at the time they began production. It was impossible to obtain accurate figures for the bleaching of the vent, eyering and earlobes because the observations were taken only every two weeks during the first five months of the experiment. These three parts of the body bleach out so quickly and so nearly together that these observations did not show any appreciable difference in the time required. The average of the

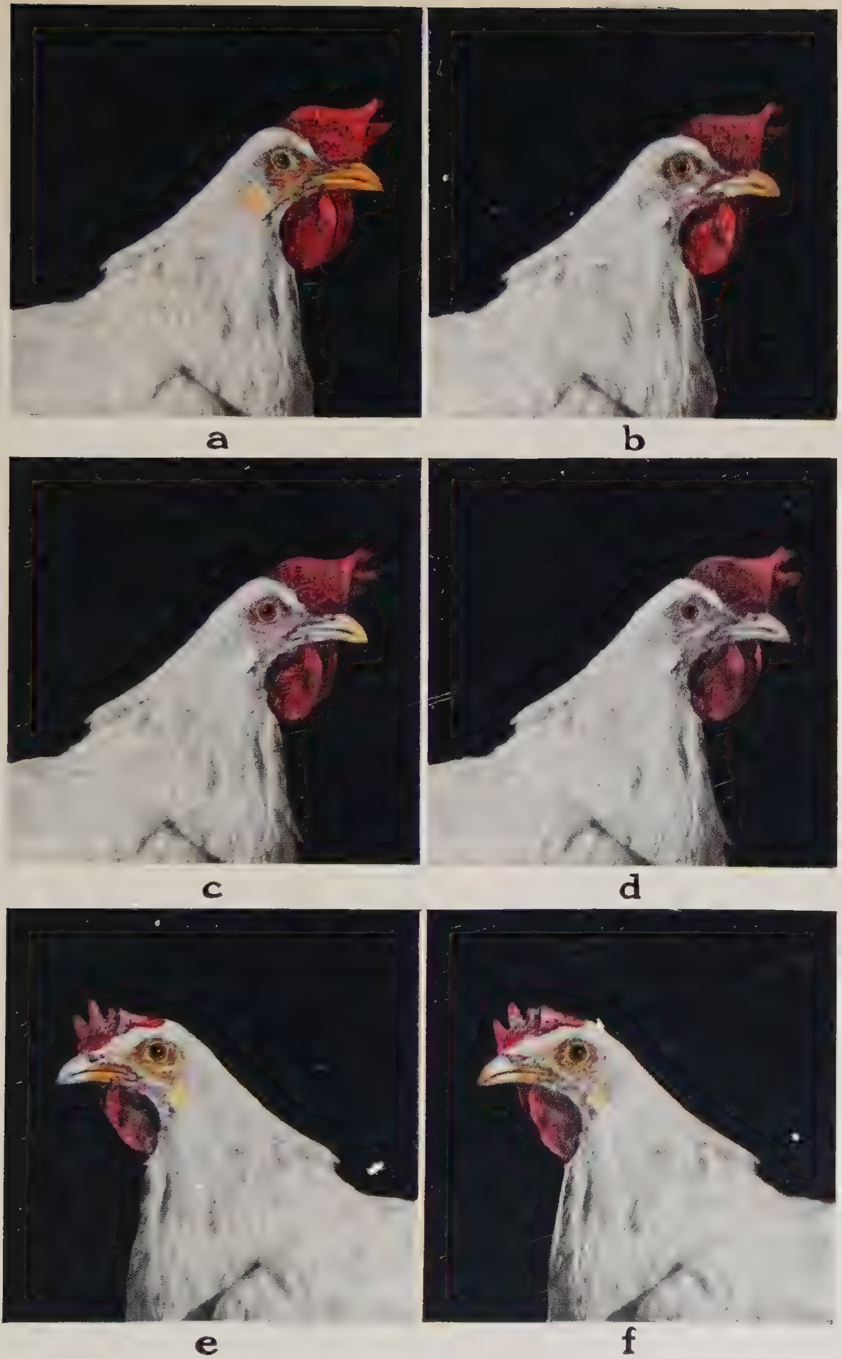


Plate I.—Pigmentation Changes Which Are Visible in the Head.

a. A deeply pigmented pullet at the time of laying first egg.
b. A pullet showing the eyering, earlobe, face and one-half of the beak bleached.
c. This bird shows only a trace of pigment left in the tip of the beak.
d. The head sections of this bird are entirely bleached.
e. After ceasing production, pigment has returned to the eyering, earlobe, face and to the base of the beak of this bird.
f. This bird did not lay long enough to bleach the beak completely before ceasing to lay, as indicated by the small amount of yellow color at the tip of the beak.

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figures for each of these three parts, the vent, eyering and earlobes, was between 9 and 10 eggs. Very often birds are found where some bleaching of the vent is apparent before any eggs are laid. This is explained by the fact that it takes ten days to two weeks to form an egg-yolk and during this period when the xanthophyll supply is cut off some bleaching around the vent takes place. Lewis states that 6 eggs will bleach the vent and 10 to 15 eggs will bleach the eyering and earlobes. It was found that the vent of some birds might be entirely bleached by the time the first egg was laid and in a few instances the eyering and earlobes were practically bleached by the laying of the first egg. On the other hand, some of the birds did not become bleached in the vent, eyerings or earlobes until they had laid as many as 20 eggs. The explanation for this will be taken up in a later paragraph.

Bleaching of the Beak.—The following figures show the production necessary to bleach the beak varying amounts.

	Average, Eggs	Range, Eggs
To bleach one-third white	11.0	2 to 21
To bleach one-half white	19.0	3 to 30
To bleach two-thirds white	23.3	11 to 41
To bleach four-fifths white	29.1	18 to 35
To bleach entirely white	35.5	18 to 62

Lewis states that the beak on the average will bleach white by the laying of 30 to 40 eggs. This is equivalent to approximately seven to eight weeks of production when the birds are laying at a fair rate.

Plate I shows the order of bleaching and return of the yellow pigment, xanthophyll, found in all yellow-skinned breeds. This plate illustrates these changes in the different sections of the head. Head *a* shows the deep yellow pigment in the earlobe, eyering, face and beak of a pullet just previous to or at the time of laying the first egg. In most cases there would be little evidence of pigment changes in these sections of the head with the laying of the first egg. Slight changes might be detected in the vent. Observe the extremely red condition of the comb, wattles and face of this bird. This is characteristic in a pullet at the time of laying the first egg. The comb is warm, full and waxy.

Head *b* shows the pigment changes which are characteristic of the average pullet after she has laid approximately 20 eggs. The pigment has entirely disappeared from the earlobe, eyering, face and the base of the beak. Note that the pigment first disappears from the end of the beak attached to the head. On the average Leghorn pullet the beak will be about one-half bleached when she has produced approximately 20 eggs. The front portion of the beak shows a slight loss of the deep yellow color but there is still a distinct line between bleached and unbleached sections. The comb, wattles and face have lost, in some degree, the extreme red color of the pullet shown in *a*.

Head *c* is similar in all respects to head *b*, except that more pigment has bleached from the beak. Only the extreme tip of the beak carries any trace of yellow color. This is most visible on the upper mandible. The average Leghorn pullet will show this degree of pigment after laying approximately 30 eggs.

In head *d* the pigment has entirely disappeared. This condition is reached on the average pullet when she has laid 35 eggs. However, it is impossible to estimate accurately the number of eggs laid by use of this character after the beak is entirely bleached. One must refer to the shanks for evidences of longer periods of production.

When a hen ceases production the yellow pigment normally returns in the same order as it bleached. Head *e* shows this condition in a bird which had ceased production several days previously. Observe the yellow pigment in the eyering, earlobe, face and base of beak. The comb and wattles have contracted and have lost much of the red color. The fact that the beak is entirely bleached at the tip would indicate that the bird had been in production at least long enough to bleach this section.

The presence of a small amount of pigment in the tip of the beak in head *f* would indicate that this bird had not laid for a long enough period to entirely bleach the entire beak. Cessation of production for a few days, with the normal return of yellow pigment in the base of the beak, will give a condition such as shown in head *f*. This leaves a white band across the middle of the beak with yellow pigment on both ends. The reverse of this condition is often found where each end of the beak is bleached but there is a yellow band in the middle. In such birds production has continued for a long enough period to bleach the beak entirely. Production has then ceased and yellow pigment has returned to the base section of the beak. With the return of production bleaching again occurs at the base of the beak. When observed after the production of a few eggs one finds a distinct yellow band of color in the middle section of the beak.

The Bleaching of the Shanks.—In this group of birds only eleven continued in steady production for a long enough time so that the entire shank became bleached. Many of the other birds were entirely bleached but they took periods of rest at some time during the year and

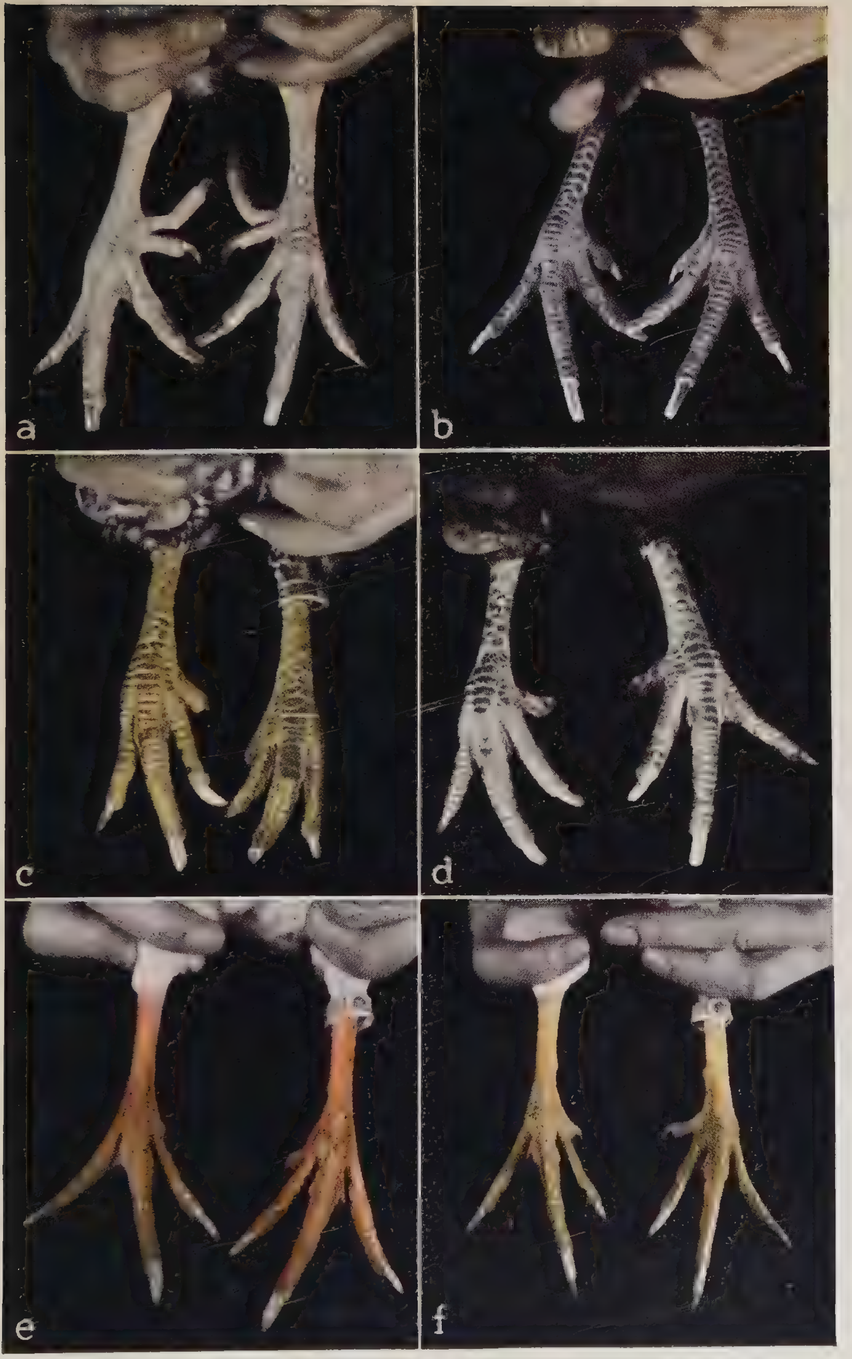

PLATE II.—Common Shank Colors in Fowls.

a. The shanks of a Silver Gray Dorking female, a white skin, white shank variety.
b. The dark slate-colored shanks of the Black Minorca.
c. The yellow shanks of a Barred Plymouth Rock before bleaching. The shanks should be yellow, but many show black spots or a greenish-black cast.
d. The shanks of a Barred Plymouth Rock after the yellow pigment has bleached due to production. Note that the black spots do not bleach.
e. The normal, deep-yellow-colored shanks of a White Leghorn. This color is common to most yellow skin varieties.
f. The shanks of a White Leghorn after several weeks of production.

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hence they had an opportunity to take in and replenish some pigment. The average number of eggs laid by these birds to bleach the various parts of the shanks were as follows:*

	Eggs
To bleach the bottoms of the feet	67.8
To bleach the front of the shanks	95.9
To bleach the back of the shanks	159.0
To bleach the tops of the toes	175.4
To bleach the hock joints	180.7

From this it may be seen that birds carrying a deep yellow pigment in the fall of the year may go through the full laying year and yet not become entirely bleached. One of the birds that was examined weekly for pigmentation and molting information did not lose all of the yellow color originally in the shanks yet she laid 302 eggs during her laying year.

Plate II shows three common shank colors. Shanks *a* are typical of birds which normally have white skins and white shanks. This color is pinkish white or flesh colored rather than pure white. Since no change takes place in the color of the shanks of such birds this character cannot be used to indicate production quality. The dark slate-colored shanks in *b* do not change materially with production and hence cannot be used with any degree of accuracy in estimating egg production.

Shanks *c* and *d* show examples of the unbleached and bleached appearance found in Barred Plymouth Rocks. Dark spots or a greenish cast are often found present in the shanks of this variety, but are undesirable. The dark pigment does not bleach. The greenish cast is due to the presence of dark color beneath the yellow pigment. Note that the bleached condition of the shanks *d* is very similar to the natural color of the white shanks *a*. There is enough difference, however, so that the careful observer may distinguish between the two.

Shanks *e* and *f* show two degrees of yellow pigment in White Leghorns. Pullets which have been properly reared should show the deep yellow pigment shown in *e*. However, occasional birds are found with a shade of yellow color similar to that of *f*, although they have not started to lay. Birds carrying deep yellow color at the beginning of the laying season may gradually bleach to a color similar to that in *f*. With continued production the yellow color may entirely disappear.

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* Observations by H. S. Palmer and Marble, 1924–25.

How the Heavier Breeds Differ in Bleaching

In applying the pigment factor to the heavier breeds such as the Rhode Island Reds, Plymouth Rocks and Wyandottes, it must be recognized that they are larger birds and usually will have a thicker skin than the Leghorns. As a result of these two conditions the heavier breeds should not be expected to bleach as rapidly as the lighter breeds, the environmental conditions and other factors being equal.

Some difficulty is also experienced in handling such breeds as the Rhode Island Reds and properly interpreting the pigment character due to the horn-colored spots on the beak and shanks. Where the horn color is present it is best to examine the underside of the lower mandible for the presence of pigment. The horn color is least visible in this section and hence an examination of that portion of the beak will give a fairly accurate history of the pigment factor. In case of the dark spots in such breeds as the Barred Rocks or Anconas it is necessary to select such parts of the beak or shanks as are free from these spots. (Plate II.) In the case of Black Jersey Giants where the entire beak and the shanks are dark colored the pigment factor is of little value. The color of the skin can be determined to a slight extent by examining the bottoms of the feet because these parts will show the yellow color when it cannot be seen in the shanks of the bird. The bottoms of the feet bleach more rapidly than do the shanks.

The Order of Return of Pigment.—The pigment upon the cessation of production at once begins to return to the various parts of the body provided that the ration contains an adequate supply of the xanthophyll. The order in which the parts of the body regain normal pigment again is the same as that in which they bleached. When production ceases the pigment granules are again deflected toward the fatty tissues and as the concentration of these granules becomes greater the different parts of the body will change, taking on the yellowish cast. The reason why the vent, for example, becomes yellow before the beak is probably due to the fact that the circulation of the blood is greater around the tissues in that area than it is in the beak and hence the pigment as it is being transported by the blood will be acquired in these parts of greatest circulation in a larger amount than in the other regions of the body. The time required for the different parts of the body to become yellow again will depend to a great extent upon the pigment content of the feed given to the birds. The bird will as a rule become pigmented much more rapidly than it bleaches.

The rate of reappearance is also profoundly influenced by the physical condition of the bird at the end of the laying period. Birds in a depleted physical condition recover their normal pigment very much more slowly than those which are in a high state of health.

Importance of Pigment Changes.—The great importance of the pigment changes in selecting birds for egg production has been pointed out by several workers. Harris, Blakeslee, Warner and Kirkpatrick all have shown that changes in the earlobe color are important especially during the early winter months while this sensitive pigment mirror is losing color but, of little value during the spring months. The earlobes, however, gradually increase in value as a factor of selection, starting in early summer and reaching the maximum value in September and October when pigment is returning.

The value of pigment with respect to the changes in the vent, beak and legs is pointed out in Table 2.*

TABLE 2

Number of Birds and Mean Annual Production

Color Class	Vent		Beak		Legs	
	Birds	Production	Birds	Production	Birds	Production
Pale	101	189.5	114	184.3	141	178.6
Medium	91	152.2	80	163.3	104	160.5
Yellow	183	136.3	181	131.8	130	123.4
Whole Flock	375	154.5	375	154.5	375	154.5

This table shows that when observations are made in October the birds may be grouped into pigment classes that correspond quite closely with their relative production value. Sherwood (1922) and others have added further evidence of this nature, all of which substantiates the accuracy obtained as shown in the above table.

FACTORS AFFECTING THE RATE OF BLEACHING AND RETURN

1. Original Amount of Pigment.—There are so many different factors that will affect the rate of bleaching and the return of pigment that it is difficult to consider all of them in our judging work. The one of most importance probably is the original amount of pigment carried by the bird at the time production begins. In some birds the pigmented parts will be deep orange in color whereas other birds will be a very light lemon color in the beak and shanks previous to production. Naturally on a quantitative basis the one with the lemon-colored shanks will bleach more rapidly. For example, Bird No. 39 in the group which was handled for pigmentation observations was found on the first observation to have very light lemon-colored shanks. By April 21 she was completely bleached, while Bird No. 7 with very deep orange shanks on the first observation did not bleach until the following fall. The first bird was completely bleached after having laid 67 eggs and the second bird after laying 269 eggs.

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* Table taken from Storrs Bulletin 92.

2. Amount of Production.—The only true measure of past production in the case of any individual bird is not what her pigment may be at the time of the observation but how much she has changed from what her pigment was previous to beginning production. The following table will illustrate how the amount of bleaching in the case of 76 hens under observation affects production:*

Number of Birds	Amount of Bleaching	Average Egg Production
12	Less than 1 degree	80.0
40	Over 1 but less than 2	116.6
24	Two degrees or more	132.5

This shows the importance that may be attached to the amount of bleaching that has actually taken place. The only objection to this comparison as a guide in judging is the difficulty in determining how much bleaching has occurred due to the fact that no one part of the bird's body holds the original pigment. The hock joint is probably the part that holds the original pigment the longest. This may be due to the way the feathers cover the scales around the hock joints and also to the layer of fat underneath the skin at this point. However, this part will eventually bleach if production continues long enough and in such cases there is no measure of original pigment.

3. Size of Bird.—The size of the bird has been claimed to have some effect upon the rate of bleaching. It is entirely possible that the larger birds would have coarser scales that might not lose color as quickly as the thinner scales of the smaller birds. It is probable that the reason for the apparent slower disappearance of pigment from the larger birds is due to the larger weight of the body in proportions to the number of eggs laid, thus diverting less xanthophyll proportionately from the daily food intake. On one group of birds studied at Cornell University a correlation of 0.223 ± 0.074 was obtained when the size of the bird as measured by weight was correlated with the amount of pigment carried in the shanks on June 1st. There were only 76 birds involved in this correlation, hence we cannot place full dependence upon the results obtained, especially when the correlation was only three times the probable error.

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* Observations by H. S. Palmer and Marble, 1924–25.

4. Feed.—If the data presented in the earlier part of the chapter are given just consideration, we might assume that the feed given to the birds would not have any effect upon the pigment color so long as the birds are in production. After egg production had ceased, however, and the xanthophyll was diverted to the fatty tissues beneath the skin, then we might expect that the feed would have a very marked effect on the rate at which the parts of the body again acquired yellow color. A small amount of data obtained from the study made at the Cornell University Agricultural Experiment Station in 1924–1925 is presented. Due to an outbreak of disease in the flock the amount of grain given to the birds was increased on April 28, 1925. As a result of this increase 21 of the 76 birds took in sufficient pigment to color from one-half to all of the beak to a degree of 4. Entirely white was considered as 5 while a deep orange was considered as 1, so a degree of 4 would be a light lemon shade. This pigment was very slow in coming in, requiring a period of four to five weeks before it was sufficiently evident to be noticeable.

5. Range.—The amount and kind of green feed obtained on the range would have the same effect as the yellow corn given in the scratch feed or mash. Some students of judging have suggested that perhaps the kind of soil on which the birds range might affect the rate of bleaching. There is at the present time no evidence to substantiate an assumption of this kind.

6. Vitality.—Observations indicate that those birds that are low in vitality usually do not carry as much pigment because they are lacking in an adequate supply of fat. Hence such birds bleach very quickly. Likewise these birds are slower to take in pigment when production ceases.

7. Coarseness of Skin.—This is probably one of the more important factors affecting the rate of bleaching. We know that the pigment is not lost from the thick, heavy scales of the shanks as quickly as it is from the thinner, finer texture scales; hence, it may be safe to assume that the coarse-skinned bird will not bleach as quickly as the thin-skinned bird.

8. Age of Bird in Case of Pullets.—The pigment character can be used as indicating vigor and past production but has little value in predicting future production except as it indicates good health of the individual.

In case of breeding hens a lack of pigment at the close of the laying year would ordinarily indicate the lateness of laying and the physical condition of the bird. Failure to recover normal pigment prior to the breeding season would indicate faulty management or a lack of recuperative power. Such a bird would be a questionable breeder in view of the fact that the vitality of a chick is measured by the physical condition of the hen at the time the egg was laid. Breeding hens lacking proper pigmentation at the beginning of the hatching season would be likely to produce chickens deficient in pigment and of low vitality.

9. Individuality.—It is a matter of observation that certain birds in a flock are by nature much more highly pigmented than are others. This difference is apparent in all sections of the body carrying the pigment factor. For example: It is observed that in white plumage varieties, those birds carrying a heavy charge of yellow pigment show this in creamy plumage and orange colored shanks and beak, creamy colored earlobes, etc., and that birds having chalk-white plumage are likely to have lemon-colored shanks and beak.

This brings us to the question of major importance to the man attempting to place a group of birds in the show ring or to cull a flock of birds on the farm. We are safe in saying that the pigment test will indicate the extremes of egg production at any time of the year. The hen with the yellow vent, eyering, earlobes, beak and shanks can always be identified as a low producer if handled during the middle of the laying year (June to September). This does not necessarily mean that she should be disposed of on this evidence alone because at certain times of the year it is necessary for the bird to recuperate her vitality and body weight in preparation for the next year's job.

This means that special care must be used when these heavily pigmented birds are judged. This is especially true at those times of the year when heavy laying birds should be entirely or partially bleached. Always when in doubt, other characters must be used to supplement pigmentation.

CHAPTER VI

MOLT AND ITS RELATION TO PRODUCTION

In order that we may understand the particular part of the plumage or part of the feather referred to when discussing the molt, a brief outline of the makeup of a single feather and the way in which the feathers are grouped together will be presented.

The term "plumage" is generally used to include all the feathers of the body. The body plumage usually includes only the small, short feathers attached to the body proper and does not include the longer, more rigid feathers of the wings and tail.

CONSTRUCTION OF THE FEATHER

The main part or backbone of a feather is known as the stem. This stem is made up of two parts: the quill, which is cylindrical and hollow and forms the base of the feather, and the shaft, which forms the upper framework part of the feather. (Fig. 47.) A new feather can usually be identified because the quill is filled with blood and appears reddish-purple in color. As the feather develops further the blood disappears and is replaced by a parchment-like material known as pulp. The shaft is grooved on the underside.

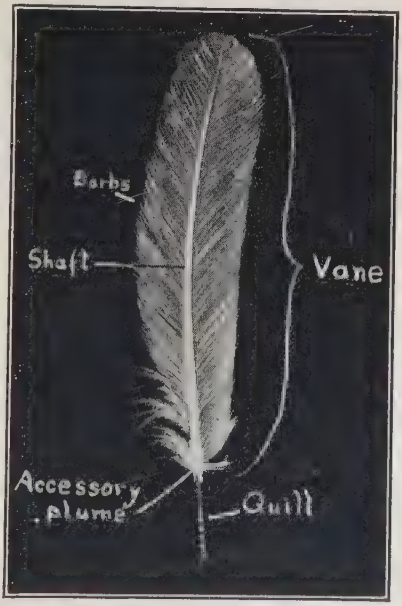


Fig. 47.—The Parts of a Feather.

The upper part of the feather is usually known as the vane of the feather. The shaft, of course, forms the framework of the vane to which the barbs of the feather are attached. These barbs are slender projections from either side of the shaft and they are attached one to another on each side of the shaft by small barbules. (Fig. 48.) The barbules are at right angles to the barbs and they have minute hooklets attached to them. These hooklets hold the adjacent barbs together thus forming a rigid surface for use in flight. All of the barbs hooked together in this way by the hooklet-bearing barbules are often spoken of as the web of the feather.

The stem of the feather has two small holes in it; one at the lower end of the quill providing an entrance for the blood of the body, and the other one at the junction of the quill and shaft. This is so located that it comes at the surface of the skin where the quill emerges from the skin. This allows the entrance of outside air and it is partially covered by a small rudimentary feather or tuft of down. This is known as the accessory plume.

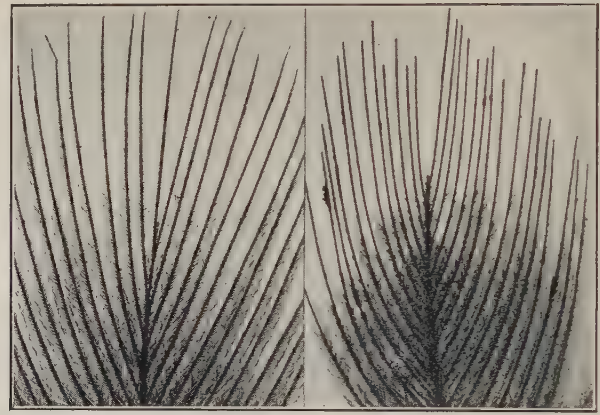


Fig. 48.—An Enlargement of the Web of a Feather, Showing the Barbs and Barbules.

These feathers have been considerably worn and show the barbs nearly naked of barbules at their tips. By this wearing off of barbules the feathers take on a different appearance which frequently is mistaken for a molt.

DIVISION INTO FEATHER TRACTS

All of the feathers of the bird are constructed alike. They vary in size, shape and rigidity. They are grouped together in tracts or groups and are spoken of by the particular tract in which they are located. From the standpoint of the student of anatomy they are spoken of as the ventral tract, femoral tract, and the humeral tract; but from the standpoint of the student of judging they are spoken of by more common terms. Ordinarily they are grouped as follows:

Head.—The small feathers on the top of the head.

Neck.—The feathers attached to the neck of the bird and extending from the head down to the junction of the neck and body.

Back.—The feathers attached to the back of the bird and extending part way down on either side of the body.

Breast.—The feathers located in the ventral tract which extends the entire length of the under side of the body.

Fluff.—The small downlike feathers on the abdomen of the bird.

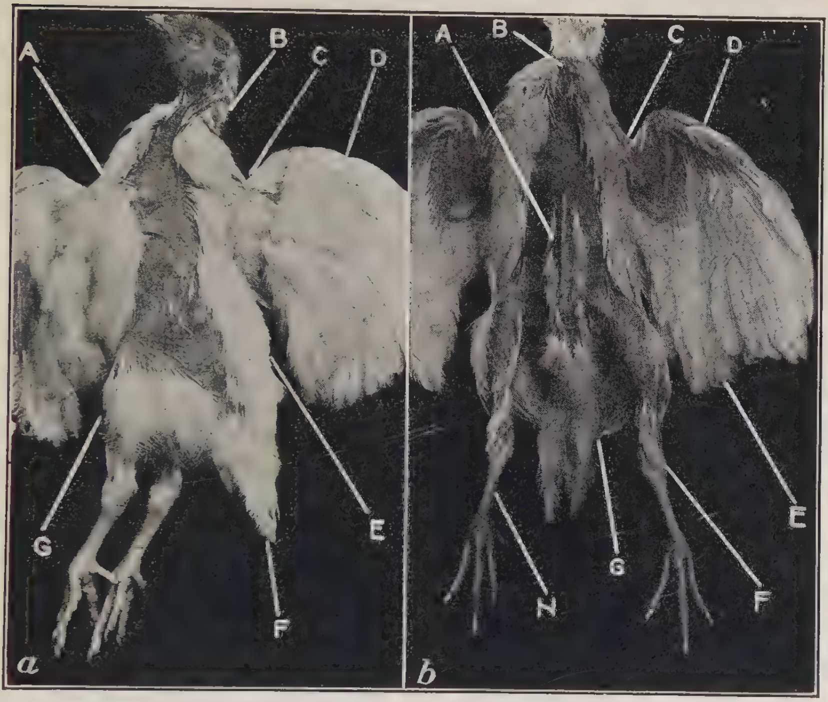


FIG. 49.—Feather Tracts in White Leghorn Chick 4 Weeks Old.

a. Side view: *A*, breast; *B*, neck; *C*, inside of wing; *D*, primary coverts; *E*, back; *F*, tail; *G*, thigh.

b. Front view: *A*, keel; *B*, throat; *C*, breast; *D*, primary coverts; *E*, secondary feathers; *F*, leg; *G*, fluff; *H*, shank.

Thighs.—The feathers located on the thighs of the bird and extending from the hips down to the hock joint.

Tail.—The fourteen to sixteen main tail feathers forming the V-shaped tail. They are placed in the shape of a V with the apex of the V just back of the oil gland. Usually in the case of Single Comb White Leghorns there are seven main tail feathers on each branch of the V, but in a small percentage of the Leghorns and a larger percentage of the heavier breeds there are eight feathers on each branch of the V or seven on each branch with a center feather directly at the apex.

Primaries or Flights.—These are the feathers forming the outer section of the wing when it is spread out from the body of the bird. There are usually ten primary feathers although rarely in Leghorns and quite frequently in the heavier breeds there are eleven. In one Wyandotte hen thirteen primaries were found in one wing while twelve primaries were counted in the other wing.

Secondaries.—This is the group of feathers nearest the body when the wing is spread out. There are fourteen feathers in this group. The secondary feathers nearest the body are quite small.

Axial Feather.—This is a single, small feather separating the primaries from the secondaries.

Finger Feathers.—These are four small feathers attached to the very outer end of the wingbow. They vary from 4 centimeters in length (about 1½ inches) for the smallest one to 10 centimeters in length (about 4 inches) for the largest one.

Many of these sections are shown in Fig 49.

Molt is Inherited.—Each year, in case of mature birds, all of these feathers are usually dropped and new ones grown in. This act or process of shedding and renewing the feathers is known as molting. This tendency to drop the old feathers and grow new ones at approximately regular intervals seems to be definitely inherited.

MOLT IN THE BABY CHICK AND GROWING CHICKEN

The young chick in its development from a baby chick to a mature bird passes through several complete molts. The first body covering of the chick is downy in nature and as a result does not drop out like normal feathers but instead has a method of molting quite peculiar to its nature. When the baby chick is hatched it has small pin feathers for flights and in two or three days it develops pin feathers that eventually become tail feathers. (Fig. 50.) The down of the chick grows longer, and on certain areas of the body develops shafts. Within a few days the shafts burst open, allowing the web of the feather to spread out. The down, however, often clings to the end of the opened feathers thus giving the ragged appearance noticeable when the chicks are two to three weeks of age. (Fig. 50.) The first body feathers appear at the throat, just above the crop, and this line extends down each side of the crop and breast. Then a tuft on each thigh and a line down the spine appear. These areas increase in size until at four or five weeks of age the chick becomes fully feathered. In work conducted at Cornell University in 1908 by Rice, Nixon and Rogers, it was found that these first feathers were completely lost and new ones grown in again at the age of eight weeks. The second growth of real feathers was completed at the age of thirteen weeks. The third growth was kept until just prior to maturity when the mature plumage took its place.

There is no further change of plumage, except under certain abnormal conditions, which will be discussed later, until the bird ceases production after her first laying year. When production ceases in the late summer or fall of her first laying year, the fowl begins to renew her old, worn-out plumage. It is this renewal that we are most interested in because studies have indicated a very close relationship between certain molting factors and annual production. It is true that different individuals vary greatly in the way in which they molt and that many factors affect the time and the rate at which the molt takes place. These many factors have made the study of the molt a very intricate problem and much of this problem is still unsolved.

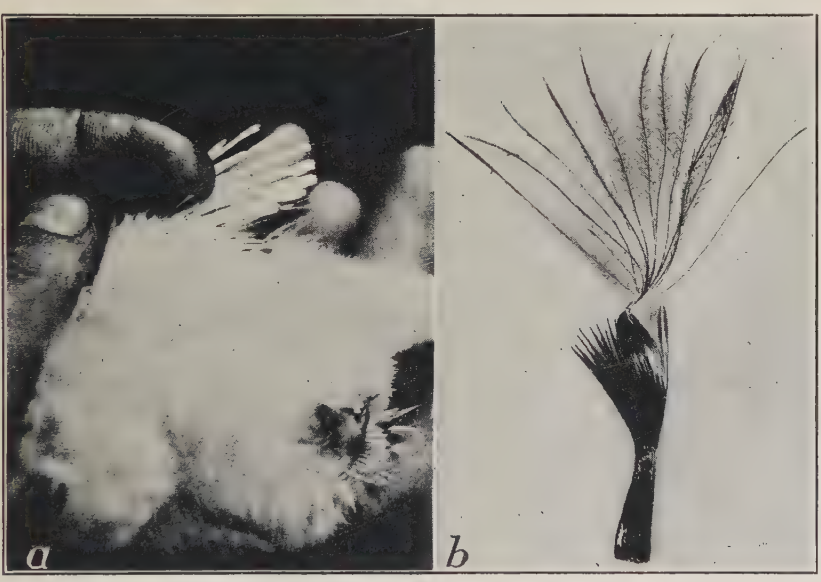


FIG. 50.—(*a*) Development of the Wing and Tail Feathers in a 3-day Old Chick. (*b*) Down Still Attached to a New Growing Feather. (Cornell Bulletin 258.)

TIME AND ORDER OF MOLT

Best Hens May Lay and Molt at the Same Time.—A few years ago the statement was constantly being made that it was not possible for laying hens to molt and still continue to lay. Work carried on during the past few years in various experiment stations points out the fallacy of this statement. As a result of a study of the molt characteristics at Iowa State College by Vernon (1926) it was found that the heaviest producers were able to continue in production at a heavy rate and at the same time drop feathers quite rapidly both in the body plumage and in the primary or flight feathers. Van Manen (1923) in an unpublished thesis at Cornell University has pointed out that birds will lay and molt at the same time only when they are increasing or maintaining their body weight. They ceased to do both as soon as their body weight began to decrease. Observations at Cornell University on two groups of birds in their first laying year indicated that 16 of the 53 birds in Flock A and 26 of the 66 birds in Flock B continued to lay for some time after they had started to molt. The average date at which these 16 hens began to molt was August 24, while in the following year for the 26 hens the average date of beginning to molt was September 8. The percentage production for the four weeks previous to the day when the first primary feather was dropped and for the four weeks following that date, with the actual amount of molt taking place in the different parts of the plumage, is shown in Table 3.

These results indicate that there was very little decrease in the production, yet during the four weeks following the day of the dropping of the first primary feather, the hens in both flocks dropped two or more primary feathers in each wing. In addition they averaged somewhat better than a slight body molt during the same period. There was very little molt in the secondaries or tail feathers. Comparison is also made in Table 3 with flocks of equal size in which the birds ceased production before or at the time of the dropping of the first primary feather. This comparison shows that while the percentage production of the birds laying and molting at the same time did not decrease, nevertheless the amount of molt, both in the wings and tail as well as the body plumage, was decidedly reduced.

The birds that have the reserve power to continue in production after the feathers have started to drop or to molt while yet in production are looked upon as the most efficient egg producers. They are to be preferred to the birds that quit laying when the molt starts. The average production of the group of 16 hens that laid and molted at the same time was 225.3 eggs per hen, whereas the production of the group that ceased to lay when molt started averaged only 145.7 eggs per bird. This is an advantage of 80 eggs per bird. Practically the same advantage existed the following year in case of the 26 birds that laid and molted at the same time.

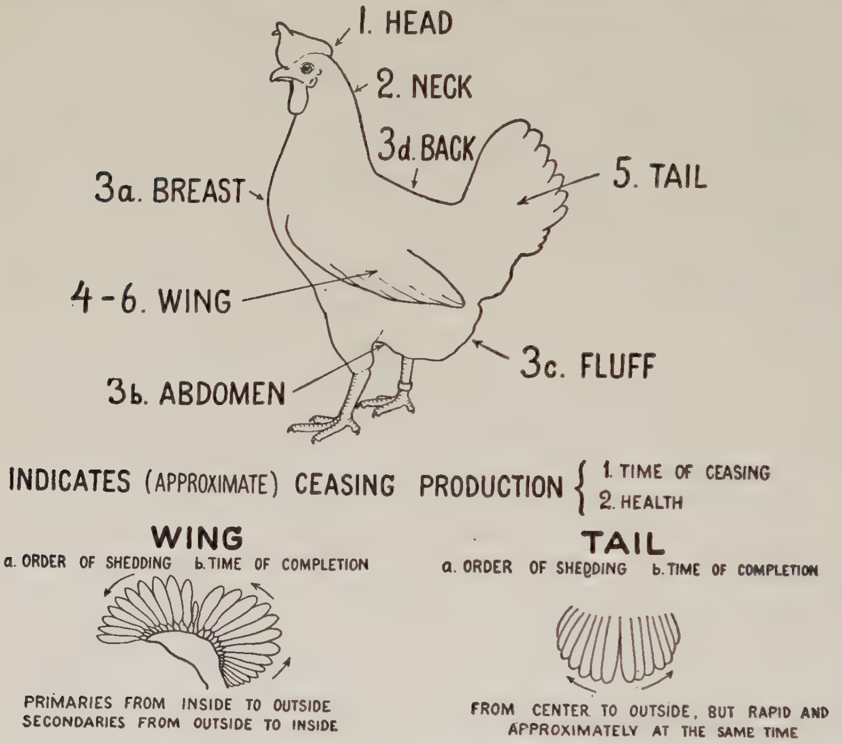
TABLE 3

THE EFFECT OF THE MOLT ON THE INTENSITY OF PRODUCTION

	Before Starting to Molt				After Starting to Molt				Total Feathers, Dropped
	4th Week	3rd Week	2nd Week	1st Week	1st Week	2nd Week	3rd Week	4th Week	
Percentage production, molting and laying:									
Flock A	70.5	74.1	66.9	71.4	64.3	66.1	63.4	61.6	
Flock B	74.2	67.0	65.4	67.0	71.4	75.3	67.0	62.1	
molting only:									
Flock A	52.0	39.0	19.0	4.0	0.0	0.0	0.0	0.0	
Flock B	61.0	55.0	29.0	13.0	3.0	0.0	0.0	0.0	
Average body molt, molting and laying:									
Flock A	2.7	4.6	4.8	4.9	7.0	7.0	7.8	8.1	
Flock B	1.8	2.1	2.6	3.1	5.8	6.4	7.2	7.4	
molting only:									
Flock A	5.0	5.3	12.3	20.7	26.5	31.4	29.8	25.3	
Flock B	2.8	3.7	6.3	17.1	27.7	31.9	32.0	26.6	
Average number primaries dropped, molting and laying:									
Flock A	.....	.....	.....	.....	1.2	0.2	0.3	0.4	2.1
Flock B	.....	.....	.....	.....	1.1	0.2	0.3	0.6	2.2
molting only:									
Flock A	.....	.....	.....	.....	1.4	0.9	0.8	0.5	3.6
Flock B	.....	.....	.....	.....	2.0	1.3	0.8	0.7	4.8
Average number secondaries dropped, molting and laying:									
Flock A	.....	.....	.....	.....	0.0	0.2	0.5	0.0	0.7
Flock B	.....	.....	.....	.....	0.0	0.1	0.0	0.1	0.2
molting only:									
Flock A	.....	.....	.....	.....	1.0	2.2	1.6	1.4	6.2
Flock B	.....	.....	.....	.....	2.5	1.7	1.3	1.5	7.0
Average number tail feathers dropped, molting and laying:									
Flock A	.....	.....	.....	.....	0.7	0.0	0.0	0.1	0.8
Flock B	.....	.....	.....	.....	0.0	0.0	0.0	0.1	0.1
molting only:									
Flock A	.....	.....	.....	.....	4.6	5.1	0.6	1.2	11.5
Flock B	.....	.....	.....	.....	3.7	3.4	3.5	2.0	12.6

Order of Molt Is Fairly Definitely Fixed.—The order of the molt in the domestic hen is very definite. We find a few birds that vary slightly from the usual order but in general the variations are so few and of such small significance that they may be disregarded.

Body Molt.—Fig. 51 gives us in a diagrammatic way the usual order of molt in the body plumage. It will be noted that the head and neck feathers are the first ones to drop out. The feathers on the front of the neck do not drop out as quickly as do those on the back of the neck. Very often in a false molt brought on by faulty feeding or management conditions the molt will be confined to the head and neck feathers. This is due to the fact that this molt on the head and neck is quite visible to a careful feeder or observer and steps can be taken by the poultryman to counteract or stop the molt before it progresses any further, or what is more likely to occur, the cessation of production enables the bird to recuperate and therefore renew the feathers.


1. HEAD
2. NECK
3d. BACK
5. TAIL
3a. BREAST
4-6. WING
3c. FLUFF
3b. ABDOMEN
INDICATES (APPROXIMATE) CEASING PRODUCTION { 1. TIME OF CEASING 2. HEALTH
WING
a. ORDER OF SHEDDING b. TIME OF COMPLETION
PRIMARIES FROM INSIDE TO OUTSIDE
SECONDARIES FROM OUTSIDE TO INSIDE
TAIL
a. ORDER OF SHEDDING b. TIME OF COMPLETION
FROM CENTER TO OUTSIDE, BUT RAPID AND APPROXIMATELY AT THE SAME TIME

Courtesy Poultry Department, Cornell University.

FIG. 51.—The Different Plumage Sections of a Bird and the Order of Dropping and Renewal of These Sections.

Following the head and neck molt we find that the molt begins in the other parts of the body proper at about the same time. The feathers on the back of the body, the breast, fluff, and thighs all begin to drop at approximately the same time. Usually the body molt will have commenced by the time the wing and tail feathers have started to drop.

The Tail Molt.—The order of the tail molt is not uniform. Usually the innermost pair of feathers will molt first, but occasionally the molt will be scattered throughout the tail with no uniformity. In a good producer that is molting rather rapidly it is not at all unusual to find that the entire tail has dropped at approximately the same time.

The Wing Molt.—The order of the molt in the wing is quite regular, especially in Leghorns. More variations seem to exist in case of the heavier breeds. The order of molt in the wing may be followed quite closely by studying Fig. 52. This figure shows twelve reproductions of drawings of the left wing of one of the hens on which weekly observations were made at Cornell University. The drawings are made to scale and represent the actual lengths of the respective feathers as they were measured each week. Observations were made on 53 laying hens from November 1, 1924, to March 20, 1926, and on 66 laying hens the following year. Notations were made as to the amount of molt taking place in each part of the body plumage. Five different degrees of molt were used. The tail feathers and secondary feathers that were being renewed were noted and measurements to the nearest centimeter were made of all of the primary feathers that were in the process of growth. The production of the hen from which the measurements were taken in order to make the drawings shown in Fig. 54 was 162 eggs during her first laying year. The molt of this hen was slightly more rapid than we would expect to find in a hen of this production but the order of the molt was practically identical with the order shown by all of the 119 birds. The diagrams will be of considerable aid in supplementing the description of the order as given in the next few paragraphs. The old feathers are shown in this chart in solid color while the new feathers are shown in a much lighter shade.

The primaries, as a rule, will start to drop out a few days before the tail feathers. Ordinarily the secondary feathers will start to drop out about the same time as the tail feathers. Where the bird continues to lay after the primaries have started to drop the secondaries are several days or perhaps weeks later in dropping.

As already pointed out, the primaries began to drop a few days before the secondaries. With birds that ceased production soon after the molt started this delay was very short, but with birds that continued to lay for several weeks after the primaries began to drop this delay was often as long as the period of combined molt and produc-

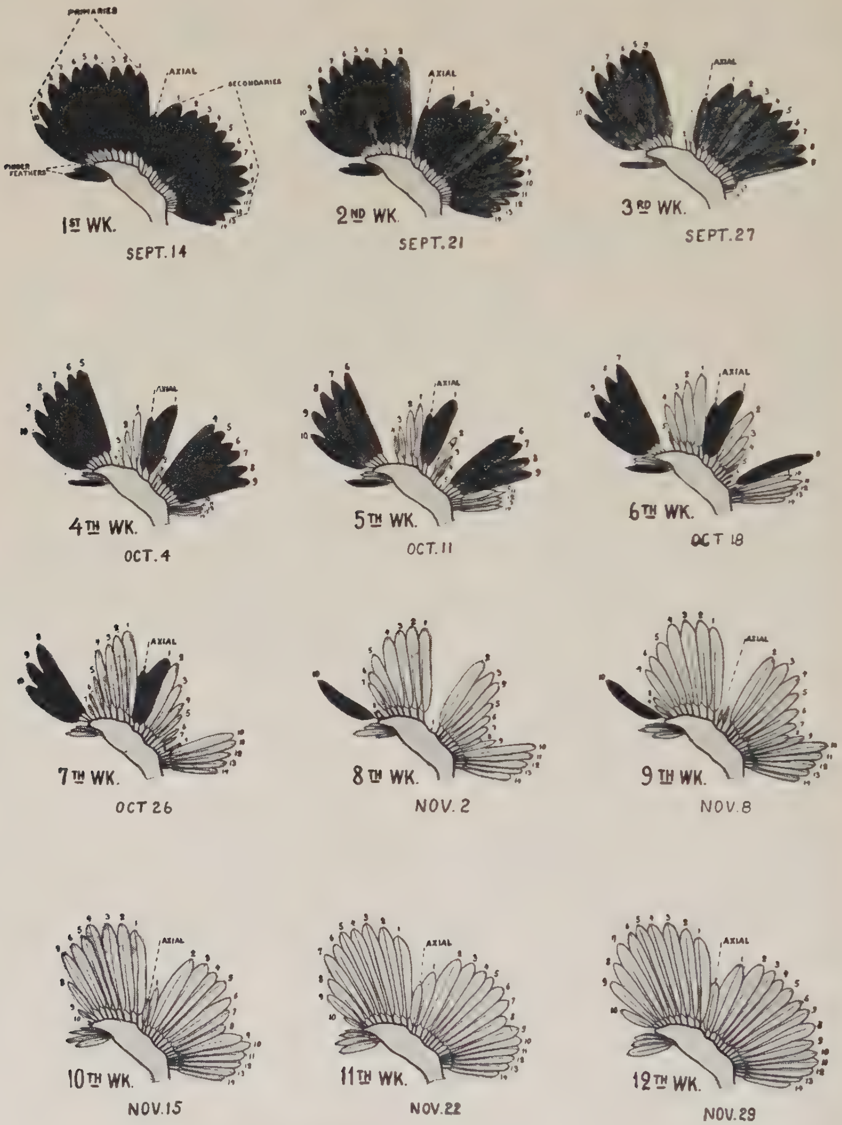

PRIMARIES
AXIAL
SECONDARIES
FINGER FEATHERS
1ST WK.
SEPT. 14
2ND WK.
SEPT. 21
AXIAL
3RD WK.
SEPT. 27
AXIAL
4TH WK.
OCT. 4
AXIAL
5TH WK.
OCT. 11
AXIAL
6TH WK.
OCT 18
AXIAL
7TH WK.
OCT 26
AXIAL
8TH WK.
NOV. 2
AXIAL
9TH WK.
NOV. 8
AXIAL
10TH WK.
NOV. 15
AXIAL
11TH WK.
NOV. 22
AXIAL
12TH WK.
NOV. 29

Fig. 52.—The Normal Order of Wing Molt in the Primary and Secondary Feathers.

tion. The primary feather next to the axial feather dropped out first in nearly every case. The primaries continued to drop out in regular order, the outer one being the last one to drop. Occasionally variations from this regular order were observed but rarely would the order be reversed for more than two feathers. The most common reversal was the second feather ahead of the first feather. The White Wyandottes seemed to reverse the order more frequently than did the Leghorns, Barred Plymouth Rocks or Rhode Island Reds. This exception is not significant.

The order of the dropping of the secondaries is much less regular than the order of the dropping of the primaries. Counting from the axial feather toward the body the order observed in this group of birds was as follows: 11, 12, 13, 14, 10, 2, 3, 4, 5, 6, 7, 8, 9, 1. It will be noted that although the regularity is not as easily followed as in case of the primaries the uniformity of this order is much more consistent than has been supposed. Vernon (1926), of the Iowa Experiment Station, working on the order of the secondary feather molt, observed a slightly different order than the one reported above. Daily observations would be necessary to determine accurately which one is correct. Both investigators agree that the four feathers next to the body are the first to drop, followed by the second one from the axial feather. The general order of the central group is from the axial feather toward the body. The last secondary feather to drop is the one next to the axial feather. The axial feather drops at the same time as the first secondary feather.

The Reason for the Order of Molt.—It is very interesting to note how the order of the molt has been worked out to meet the demands of the bird in order to provide at all times adequate feather surface for flight. In the days of the jungle fowl the necessity for sufficient feather surface to enable it to escape by flight from its enemies was imperative and a close study of the wing charts as shown from week to week indicates how this order of molting of the primaries and secondaries has been adapted to meet the needs for flight at all times. It will be noted that there are three distinct divisions of solid surface to the wing, all of which shed and renew feathers almost at the same time. This is due to the fact that the first secondary and axial feathers are left to the last part of the molt, at which time the nearest primaries and secondaries are completely grown in again.

TIME REQUIRED FOR MOLTING

The time required for the molting of the primary feathers varies widely in different birds. In general this time variation seems to be associated with egg production, the highest producers usually molting in less time than the low producers. However, it should be pointed out that this relationship is not one hundred per cent because many other factors enter in, thus offsetting some of the influence of inherited production quality.

Factors Influencing the Time Required for Molting.—Some of these offsetting factors are as follows: (1) the physical condition of the bird at the time that the molt begins; (2) the time of the year at which the molt occurs; (3) the management given the hens, especially with respect to the use of artificial lights and special feed, and (4) the length of time devoted to combined production and molt.

The high producers are much more likely to lay late into the fall of the year when the temperature is much lower and as a result require more feed for the maintenance of the body temperature and to carry on the body processes than does the lower producer that completes a large part of her body and wing molt in the late summer months when the temperature is much warmer. Finally, the feeding conditions may have a marked effect in case of many flocks because there is a general tendency to neglect the birds during the summer season on the assumption that they will find their own living, or if fed at all, the rations are frequently inadequate even on commercial poultry farms. The highest layer, due to the fact that she lays later into the fall, is more liable to be molting during this time of neglect while the lower producer mixed in with many hens that were still laying earlier in the season had better feeding conditions thus enabling her to make more rapid progress in growing a new coat. Most of the instances in which the high producers have taken a long time in which to renew their feathers could be explained by one or more of these offsetting factors.

The experience of practical poultrymen will show that molting hens require an adequate ration for molting just as much as they do for laying. The ration probably affects the rate of molt in many flocks.*

These irregularities in the rate of molt do not occur often enough to overbalance the effect of production quality and as a result a direct correlation is found between the time required for molting and egg production.

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* Ackerson, Blish and Mussehl, 1928, attempted experimentally to increase the rate of the molt and to prevent the normal decrease in weight at the time of the molt by adding 112 milligrams of cystine (a form of amino acid) per bird to the daily feed given to a flock of 20 birds. They found that the addition of this amount of cystine, furnishing 13 milligrams of cystine nitrogen, did not increase the rate of the molt or prevent the normal drop in body weight.

Low and High Producers Grow in New Feathers at the Same Rate

The study of the two groups of birds at Cornell University indicated that the low-producing birds grew individual primary feathers in the same length of time as did the high-producing birds. About sixty per cent of the primary feather is grown during the first three weeks of the growth period and at the end of six weeks about ninety-five per cent of the feather is completed. Table 4 shows the percentage of the primary feathers grown each week. In no instance did an individual feather become completely grown in less than six weeks and many of the feathers required seven weeks to complete the growth. The shape of the feather did not apparently have any effect on the rate of growth. The pointed feather seemed to require just as long to grow as did the round, blunt feather. It did require longer for the long feathers to grow than it did for the shorter feathers.

TABLE 4

Percentage of Total Length of Primary Feathers Grown in Each Week

(Feathers Reaching 18 Centimeters)

Egg Class	1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week	7th Week	8th Week	9th Week
Below 140 eggs....	23.2	20.9	17.4	16.9	9.6	6.9	3.7	1.4	......
141–180 eggs......	19.2	21.8	19.0	15.4	10.6	7.7	4.5	1.8	......
181–220 eggs......	21.7	21.5	18.8	15.0	11.0	6.6	3.8	1.7	......
Over 220 eggs.....	21.3	21.3	19.7	14.5	11.6	5.8	4.7	1.2	......
(Feathers Reaching 19 Centimeters)									
Below 140 eggs....	19.8	20.8	18.1	16.1	9.5	8.5	2.8	2.9	1.5
141–180 eggs......	19.0	20.9	18.7	15.8	10.7	7.3	4.1	3.1	.5
181–220 eggs......	22.9	20.3	17.4	15.3	11.1	6.1	4.1	2.1	1.0
Over 220 eggs.....	18.9	21.1	18.8	15.0	11.9	6.7	3.4	4.3	......

Rate of Dropping the Primary Feathers

Since there is no difference between the high- and low-producing birds in respect to the rate of growth of the primary feathers we would expect to find some variation between these two groups when we consider the rate of dropping of the primary feathers or the time between the dropping of one feather and the next successive feather. Such a condition would have to exist if we were to get more rapid molt in case of the high-producing birds than we did in case of the low-producing birds. As shown in Table 5 this difference actually did exist in the case of the two groups of high-line birds and the one group of low-line birds studied at Cornell University.

TABLE 5

Rate of Dropping of the Primary Feathers in Relation to Egg Production

(Published Data, Cornell University)

High Lines—1924–1926

Egg Group	Number of Primaries Dropped	Date First Primary was Dropped	Days between Dropping of First and Last Primary	Days per Primary Feather Dropped	Days in Production While in Molt	Net Days in Molt	Net Days per Feather	Eggs Laid While Molting
Below 140..	11.1	July 29	150.0	15.0	12.7	137.3	13.7	8.5
141 to 180..	10.5	Sept. 3	109.3	11.5	23.1	86.2	9.1	12.8
181 to 220..	10.8	Aug. 23	145.7	14.9	57.8	87.9	9.0	39.9
Over 220...	11.8	Aug. 11	161.9	15.0	100.3	61.6	5.7	63.2
High Lines—1925–1927								
Below 140..	9.0	Aug. 20	125.0	15.6	15.0	110.0	13.7	9.8
141 to 180..	9.1	Sept. 15	96.3	11.9	21.3	75.0	9.3	12.8
181 to 220..	9.8	Sept. 29	97.9	11.1	29.3	68.6	7.9	19.3
Over 220...	9.5	Sept. 21	113.5	13.4	58.1	55.4	6.6	39.3
Low Lines—1925–1927								
Below 100..	10.8	Aug. 1	138.8	14.2	13.7	125.1	12.7	8.5
101 to 140..	10.5	Aug. 13	107.6	11.3	4.1	103.5	10.9	2.2
Over 140...	10.0	Aug. 16	131.7	14.6	31.3	100.4	11.1	18.1

An analysis of this table indicates that the low and the high producers dropped about the same number of primaries, although the first group of high-line birds dropped more feathers than the second group. This difference was due to an epizootic of roup in the first group that caused a slight molt in early spring and resulted in a larger amount of molt for the year because most of those feathers that were dropped in the spring were renewed again the next winter. This removes the possibility of a shorter molt period due to the failure to drop all of the primary feathers. This further emphasizes the discussion of how disease may be responsible for differences in physical characters.

If we consider the time between the dropping of the first and last primary feathers as the time required for molt we find that in case of the three groups studied there was no clear-cut difference between the low and the high producers. This is unfair to the best birds, however, because many of those birds continued to lay while they were molting. If these birds had ceased production and molted completely before starting to lay again they probably would have shortened the molt period slightly. The rate of production is not materially affected by the molt but the rate of molt is slowed up by the production. The number of days in production while in molt is shown in column six of Table 5. Note that the low birds do not continue in production nearly as long after starting to molt as do the high producers. As indicated in the seventh and eighth columns the net days in molt decreases as the production of the bird increases.

This study of rate of dropping might be summed up in the statement that there is no material difference in the molt period of different egg production groups when the total period of molt is considered, but when those birds that continue to lay after they start to molt are given credit for that production and are not charged up with time for molt as long as they are performing the two operations at the same time, the high producers will require less time for their molt than will the low producers. This shorter time that is required is due, not to differences in the number of feathers dropped or the rate of growth of an individual feather, but to the time saved by performing two jobs at one time.

BODY MOLT COMBINED WITH PRODUCTION

The best birds not only molt the primaries while still in production but they also molt the body plumage. Table 6 shows the index value of the molt and Table 7 the percentage of the total body molt, during the year, that was performed during the production period. The percentage increases as the egg production increases. The index value of the molt was obtained by giving arbitrary values to different degrees of molt and then computing the actual molt for each week and totaling for the year.

Table 6 indicates the amount of molt in the body plumage in the different egg production groups. The 1925 group is much larger than the other groups due to the epizootic of roup. Also note that the higher producing groups did not molt as much in the body as did the lower production groups. In one bird that laid only 19 eggs during the year three distinct body molts were recorded. Pin feathers were found on her body every week of the year.

TABLE 6

AMOUNT OF BODY MOLT IN DIFFERENT EGG PRODUCTION GROUPS WHEN DIFFERENT INDEX VALUES ARE ALLOWED FOR VARYING DEGREES OF MOLT

Egg Group	High Lines		Low Lines
	1925	1926	1926
Below 100 eggs	....	....	357.0
101 to 140 eggs	479.5[1]	308.8[1]	329.0
141 to 180 eggs	407.5	306.8	279.0[2]
181 to 220 eggs	370.5	285.0	
Over 220 eggs	370.5	270.0	

[1] These two groups include all birds laying less than 140 eggs.

[2] This group includes all birds laying over 140 eggs. There are two birds in the group laying over 180 eggs.

TABLE 7

AMOUNT OF BODY MOLT PREVIOUS TO CESSATION OF PRODUCTION GROUPED ACCORDING TO EGG PRODUCTION

(Published Data, Cornell University)

Egg Group	High Lines				Low Lines	
	1925		1926		1926	
	Index Value of Molt	Per Cent of Total	Index Value of Molt	Per Cent of Total	Index Value of Molt	Per Cent of Total
Below 100 eggs	......	....	......	....	9.8	2.7
101 to 140 eggs	0.0[1]	0.0	18.0[1]	5.8	18.3	5.6
141 to 180 eggs	23.7	5.8	21.6	7.0	31.9	11.4[2]
181 to 220 eggs	28.4	7.6	30.0	10.5		
Over 220 eggs	63.8	17.2	58.7	21.7		

[1] These two groups include all birds laying less than 140 eggs.

[2] This group includes all birds laying over 140 eggs. There are two birds in the group laying over 180 eggs.

EFFECT OF VACATION MOLT ON THE ORDER OF MOLT

When a bird takes a vacation period during the winter or early spring and drops a few of the primaries and then ceases to molt and goes back into production again, she will start molting again in the fall at the point where she ceased previously. For example, if she drops three primaries during the vacation molt she will start with the

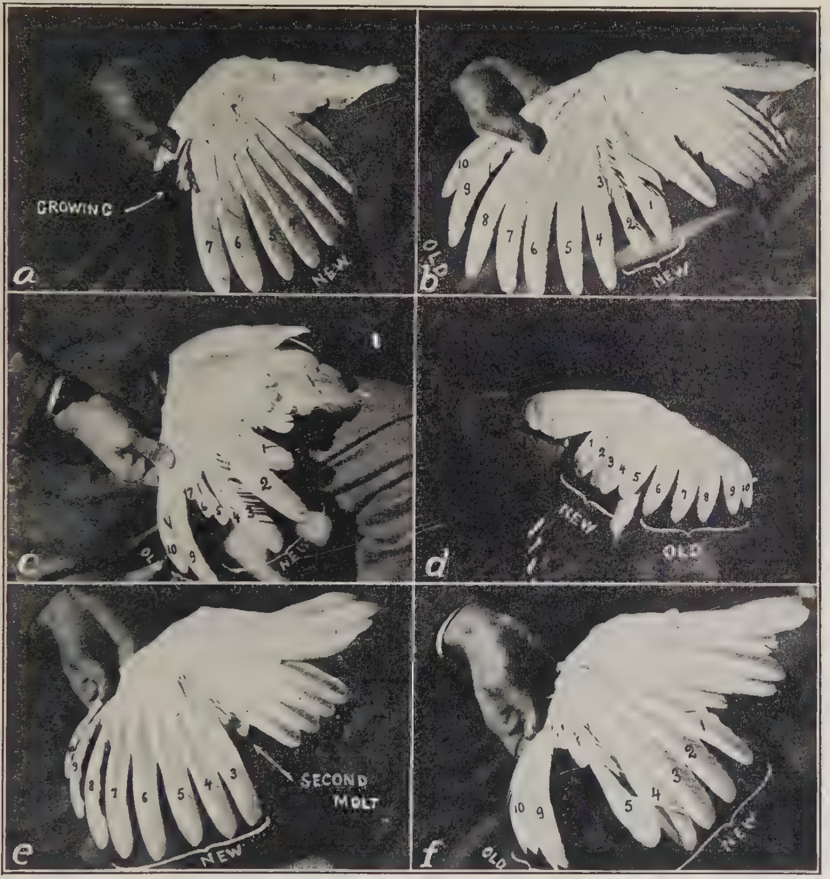


FIG. 53.

a. The order of molt in PP17 is regular. This bird dropped primary feathers 1, 2, and 3, ceased molting and came into production again. Later feathers 4, 5, 6, and 7 were dropped in another vacation molt. After coming into production again for a short time feathers 8, 9, and 10 were dropped at which time the bird ceased production for the year. Her production was 220 eggs.

b. Primary feathers 1, 2, and 3 were dropped in the wing of PP20 and new feathers grown while the bird was still in production. Her first year production was 255 eggs.

c. The wing of PP7 showing rapid molt after secession of production. First year record 272 eggs.

d. Wing of PP93 showing new and old primary feathers. She had a vacation period of six weeks during which time she molted the five feathers. First year production 241 eggs.

e. Wing of PP54 molting the second time. She required twenty-three weeks for her first wing molt. First year production 19 eggs.

f. High producers often drop several feathers at one time. PP49 molted five feathers while still laying. Feathers 6, 7, and 8 were dropped at approximately the same time. First year production 258 eggs.

fourth primary when she starts to molt again. (Fig. 53*a*.) However, after she has completed dropping the remainder of her primaries she will usually start over again with the first primary and repeat again on those feathers dropped during the vacation period. This procedure was followed in the case of 22 different birds that took vacation periods. If the vacation occurs the previous fall in the form of a late fall molt in pullets that started to lay early, then the normal order of molt will be followed in case of the molt at the end of the first year of production.

A Study of Actual Wings of Birds Tells Interesting Facts

In order to illustrate how certain factors may be detected by a study of the wings of different birds several examples have been shown in Fig. 53. Bird No. 20, in Fig. 53*b* shows a molt in the primaries, the first three feathers having been dropped and having nearly grown in again at the time the photograph was taken. This wing is very typical of the best producers in October when they are still in production but at the same time are slowly renewing their plumage. A close inspection shows that the secondary feathers had not started to drop at the time the photograph was taken. When the bird is molting the secondary feathers and the tail feathers, as well as the primaries and the body plumage, she will usually cease production and make a complete job of the molt.

Bird No. 7, in Fig. 53*c*, indicates the rapid molt very often found on the best birds after they cease production. She had dropped three of the ten primaries before ceasing production and she dropped the remaining seven primaries within the next five weeks following the cessation of production. The illustration shows where five of the remaining seven feathers had already been dropped out and the remaining two dropped the week following the time the photograph was taken. The secondary feathers in this bird were practically all dropped out as shown by the illustration.

Bird No. 93, in Fig. 53*d*, molted part of her primaries and then went back into production again. The new feathers may be recognized from the old ones by the slightly whiter or glossier condition and the shorter fifth feather. A vacation molt, whether it is in the first fall of the early laying pullets or during the winter or at some other time, can always be detected by the fact that the last feather to drop is always shorter or in some instances longer than the ones on either side of it. Both conditions have been observed, but ordinarily the last feather to drop will be slightly shorter and the half circle formed by the outer edge of the feathers is broken at the point of the shorter feather. This condition may be due to the bird starting in production again and hence less food material is left available for growing feathers.

Bird No. 54 shows a typical poor producer starting through the second wing molt. (Fig. 53*e*.)

Bird No. 49 shows three feathers dropped at approximately the same time. (Fig. 53*f*.)

This study of the several groups of birds at Cornell University revealed a few birds that were very low producers which went part way through their molt the second time. The only other time that a second molt was observed was in the case of the vacation molters where a bird repeated on those feathers which were dropped during the vacation period. These two groups of birds can usually be kept separate and not mistaken one for the other because the vacation molter will show the shorter feather somewhere in the wing, indicating to the observer that she had taken a vacation. The poor layers that repeat part of their molt usually do not cease in the molting process; hence all of the feathers that have been completely renewed will be full length. Great care should be taken to avoid an error in identifying these two groups of birds.

DISTINGUISHING THE RAPID MOLTER

One of the most difficult problems to interpret in the case of individual birds is the question of the rapidity of the molt. The best measure of this rapidity is the relative length of the growing primaries. If the difference in length between successive feathers is very small and the bird is renewing several of her primaries at one time, one can be fairly sure that the particular bird is a rapid molter. Fig. 53*f* shows the wing of a bird of this type. Such a bird would be valued higher than another bird having greater differences between the successive primaries. It is assumed that other factors of pigmentation, body type and head type were similar in each instance.

The bird that is molting and laying at the same time should also be given preference over the bird that ceases production prior to the molt. An exception to this last statement will be found and should be considered in case of birds that lay heavily up until snowfall. Occasionally such birds will not molt at all until forced to do so by changed feeding and management conditions. These birds would not necessarily be given the preference over the bird that molts early but continues to lay for a time. A bird should not be discounted for molting late in the fall even when compared with a bird that both lays and molts at the same time. The one will probably lose about the same time as will the other by the time she has renewed her coat of feathers and is ready for another year of production. The important point is that the early molter may not be a poor producer because she may be still in a laying condition. This laying condition can be recognized by pigment and the characters indicating present laying condition. The time that she ceases production is the important thing to know rather than the time she began to molt. We attempt to determine how long an individual bird has been out of production by the time she has been molting. To do this one should be careful to check pigment with the molt to determine if the bird actually was out of production as long as the molt would indicate.

Body Weight Affects the Molt

There is another factor that undoubtedly has an important part to play in the question of the rate of molt. No doubt there is an inherited relationship between egg production and the rate of molt, but all studies of data on molt would indicate that there is considerable effect upon shedding of feathers due to the physical condition of the bird at the time of the molt. The bird that is low in body flesh and weak as the result of either heavy production or disease conditions will not molt as rapidly as a bird that is in better flesh. Van Manen (1923) in unpublished data at Cornell University pointed out that birds which were gaining in weight at the time the molt began could continue for a longer period in production, whereas with the birds which were losing in body weight the tendency was to cease production. Birds maintaining a constant weight were also able to continue in production and molt at the same time. The time and rate of molt, therefore, are influenced by feeding and management.

Time of the Molt May Affect the Rate of Molt

There is considerable evidence to indicate that the rate of molt is partially dependent upon the time of the molt. When the bird gets an early start in the summer there is not the same demand for rapid growth of the feathers to provide protection from the cold as there is during the late fall and winter months. This may have some influence on the rate of molt.

Failure to Molt all of the Primary Feathers Most Characteristic of High Producers

A small percentage of any flock of birds will carry over one or more of the old primary feathers. This is not necessarily a characteristic of the best birds, although as a rule the best birds will carry over more old feathers than the lower producers. The carrying over of feathers is mainly a matter of the influence of the season and the vitality of the birds. The fact that the poorest producers molt earliest gives them more favorable weather and a longer time in which to complete their molt than in case of the late layers that do not begin to molt until cold weather sets in. The effect of cold weather is to sharpen the appetite for food to furnish heat for the body. This extra amount of food helps to hasten the renewal of the feathers.

The rate of molt under normal conditions in case of the body plumage is a reliable guide in the determination of production quality. The poorest bird will drop a few body feathers at a time but never will drop a sufficient number to look bare in spots. The best birds will often drop practically all of the body feathers at one time. This is no doubt due to the inherited urge to lay calling upon the body for material to make feathers and to a high vitality to furnish the nutriment to sustain production. A late laying and late molting hen therefore must be doubly valuable. This being true, special care should be taken on the part of the poultryman to prevent these birds from becoming chilled during the cold days in early winter. The latest layers, being better producers, are most likely to drop all of their body feathers at approximately one time and often require additional care for a few days. Fig. 54 shows a bird that dropped her body plumage quickly. Fig. 55 shows a bird that laid two years without a complete molt.

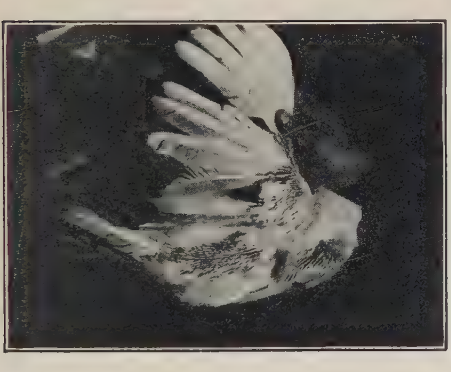
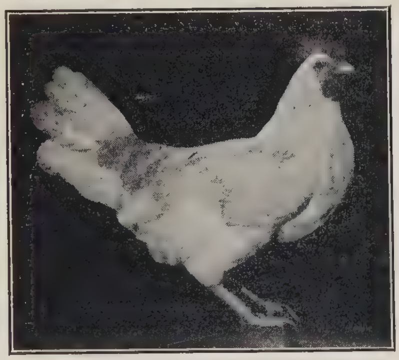


FIG. 54.—A Bird Showing a Very Rapid Body Molt.



Courtesy of J. A. Hanson.

FIG. 55.—This is Hen No. 472.

Her first year record was 328 eggs; her second year record was 310 eggs. She laid two years without a complete molt. This is shown by the rough feathers. The photograph was taken on the last day of her second year of production.

Do Not Force a Premature Molt

There has always been discussion among poultrymen regarding the advisability of forcing an early molt in order, theoretically, to get the birds back quickly into late fall and winter production. The bulk of the evidence indicates that time is lost by forcing an early molt. This is offset to some extent by the high egg prices in the early winter, but they are not sufficiently higher than the price of eggs in the late summer to offset the loss of time for the molt. Management conditions will usually control the profitableness of such an attempt to shift the time of the molt. When the poultryman has a large enough flock of the early molters, that molted early due to management conditions rather than to poor production quality, to warrant special care for these birds it will often pay to force them for fall and early winter production. The big objection lies in the fact that these birds should be disposed of in early spring and the housing space is left unoccupied.

A few breeders contend that the normal early molter will get back into production earlier than will the late layer and will lay more eggs the following winter. The Missouri station observed 200 S. C. White Leghorns in 1921, and found the results shown in Table 8, when they grouped these birds according to the time at which they molted.

TABLE 8

Molting Date	Total Eggs First Year	Winter Eggs Following Year	Total Eggs Following Year
July 1	122.0	22.4	103.5
August 1	132.0	19.8	114.5
September 1	142.4	23.1	122.7
October 1	157.7	28.6	139.0
November 1	166.7	19.1	119.0
After November 1	195.0	34.5	146.3

This table indicates that the late molters came back and laid the most winter eggs and the most eggs the following year. Early molters must be given special care and management in order to make them respond in egg production during the fall and winter months.

CHAPTER VII

THE HEAD AND ITS RELATION TO PRODUCTION

The head must be considered as a composite organ of many parts consisting of the skull, the brain, the secondary sex characters, the comb, wattles, earlobes, the beak, the eyes, the ears, and the face. All of these parts functioning together involve, and are responsible for, many activities and changes indicating production qualities.

The Functions of the Head.—The head is the source of: (1) Nervous energy; (2) intelligence; (3) temperament; (4) expression; (5) disposition; (6) it is the location of the senses, including tasting, seeing, hearing, smelling, and feeling; (7) actions, including eating, singing, cackling, crowing, flying, running, mating and fighting; (8) attractiveness in form and color. The head therefore controls many parts of the body and is involved in the operation of them.

Hence the head, like the body, is made up of a large aggregation of parts each one with its own function affiliated with those of other parts of the body. Each part of the head may be examined separately, but the head should be considered as a whole when final judgment is rendered as to the vitality or production of the individual.

Great is the Responsibility of the Head.—When considered as a whole, the head is called upon to assume chief responsibility for the safety of the body. It is the intelligence arm of service. It contains the brain to see, feel, hear, taste, translate, decide and to speak. It combines in one composite section of the body a periscope, a conning tower with a telegraph system perfectly installed and possessing the combined authority of the pilot and captain of the poultry ship.

The brain, as the principal nerve center, is the dynamo which together with the many branches of the nervous system drives the machinery of the whole body: the disgestive, assimilative, respiratory, circulatory, secretory, excretory and reproductive systems.

If certain nerves are severed, the wings fail to function; if other nerves are injured, the feet are paralyzed; or if other nerves are affected the head and the neck hang limp; if one cuts a certain nerve the heart ceases to beat. Likewise the whole digestive and assimilative systems upon which the reproductive system depends cannot operate efficiently if the nervous system is out of order.

As in any electric wiring system all nerves radiate from the main trunk line, the spinal cord, of which the brain is the master motor.

It should be clearly apparent therefore why it is that birds in order to lay most efficiently must be surcharged with nervous energy and that the perfect working of the egg machine must have a brain motor which keeps on charging night and day every day in the year. The head therefore shows whether the reproductive machinery is operating, idling, or stopped.

In this respect the animal machine is unique; it is self-lubricating, self-feeding, and self-charging. All that it requires is the raw material—the feed, and the place to do business—the factory, and it will do the rest; moreover, when properly mated the poultry machine will turn out new egg machines most of which are equal and some superior to the original models.

How to Read the "Language" of the Head

The head must be studied in detail, section by section, before discussion of it as a whole.

It must be apparent that there is a major significance in the head parts in the judging of poultry for egg production. In fact, the head is the most expressive of all the physical characters. It reflects most accurately the physiological and reproductive conditions and values of birds. It is a mirror which reflects all of the many other sections of the body. This unique and important distinction belongs to the head and the head only, because it performs so many functions vital to the life and usefulness of the bird. For this reason the functions of the head as a unit as well as of each of its parts must be clearly understood before one can wholly appreciate its full significance, and hence be able to apply the principles involved in the judging of poultry.

The Head of a Mature Bird, Except in Shape, is a Variable, Not a Fixed, Character.—The appendages of the head are more variable during the life of the fowl than any other section of the body. It is this variability principally that enables one to read the language of the head when undertaking to determine health and production.

Perhaps of greater importance than that of any other single section of the head, although least possible of exact appraisal of its value, are the skull and the brain within.

The Shape of the Head Alone is not Sufficient.—The conformation of the head alone, according to our present knowledge, is not a dependable character for judging, within narrow limits, the production value of birds. In this respect, it does not differ from body type. The head is a shell and the body a framework within which are held or upon which are hung the vital functioning parts. All of these, both outside and inside, are involved and therefore must be taken into consideration. Both head type and body type therefore are the physical and the mechanical expressions of capacity and vitality.

The Inheritance of the "Urge to Lay" as the Impelling Force.—The way birds function depends upon the extent to which they have inherited the tendency to reproduce. The "urge to lay" is the impelling factor which is *revealed* in the head by condition, action and expression as much as or more than it is by mere size and shape.

If the shape of the head were the single key to the actual determination of either the productive or the prepotent values of birds, one should be able to distinguish by the sense of touch, when blindfolded, the more productive from the less productive individuals. If this were true one should be able to prophesy the future production of pullets by feeling the skull, or to estimate the past production of hens by the examination of their skeletons, and hence be able to state the approximate number of eggs laid by the individual.

Unfortunately, so far as we know, no such clearly defined method can be demonstrated accurately with poultry. The science of phrenology and the art of reading character by mechanical measurements apparently have never been worked out scientifically with either hens or persons. This limitation, however, does not justify the assumption that head size and head shape do not have value in judging for intelligence, vitality, or production. What it is desired here to convey is the fact that there are several characters other than the skull which, if considered singly, are of nearly equal importance or, if taken together, are of greater significance than the mere shape of the skull. All of the head factors when taken together may be considered of more importance in deciding vitality, and nearly equal in value when deciding production qualities, than would be true of any other single section of the body.

The Significance of Shape.—Many theories have been advanced regarding the significance of various "bumps" of the head. Walter Hogan asserted that he had discovered the bump of amativeness clearly defined at the back of the head as indicating prepotency. This assumption apparently was based upon inferences drawn from theories concerning human phrenology which may or may not have been proven. But whether true or false the fine distinctions in production values would be exceedingly difficult to determine accurately on an object as small as a chicken's head.

Intelligence Versus Intuition.—Also, the front portion of the brain, the cerebrum, and the rear portion, the cerebellum, come in for their share of attention as being involved in egg production ability. This assumption is based upon an analogy between the size, shape and quality of brains as indicating intelligence in our domestic animals and people. Birds are motivated more by the subconscious processes than by reasoning power.

No scientific data based upon accurate measurements, so far as we can learn, have yet been made available which would furnish a mechanical means of measuring and accurately estimating what a bird's production, within narrow limits, had been or would be likely to be, based strictly on shape or size of the skull, or as determined by the size and convolutions of the brain.

The Skull, the Brain and Other Head Parts when Taken Together Are Valuable.—Notwithstanding the limitations, our best production judges have fairly definite ideas regarding the general productive qualities, within wide limits, that are commonly associated with different types of heads.

How the best judges, by the use of head points, arrive at their final decisions, it is impossible always to say, since they appear to place different values upon the various parts of the head. Steup sees and feels the shape of the head. Foreman appears to look more for temperament. Each one, no doubt, is right within the limitations of the characteristics named. It is inevitable, however, that all judges, consciously or unconsciously, do and should consider all of the parts of the head in their final judgment of the bird.

While marked contrasts in the shapes of heads do have significance in judging for production, in the main the other parts of the head must be depended upon to reflect the finer distinctions of the vitality, temperament, intelligence, sex urge, and the probable laying value.

The Strain Reflects the Man.—Here again the accuracy of our conclusions is liable to be misinterpreted due to the influence which preconceived ideas of the breeder may have had in his selection of birds having heads of certain types instead of retaining or rejecting birds strictly according to their production based upon trapnest records and progeny testing results. Thus we have certain quite characteristic types of heads, as we have also types of bodies in birds of the same variety, but of different strains based largely, if not entirely, upon the owners' ideas as to what high-producing birds should be like, rather than upon the way the head developed and took shape according to the natural tendencies of the bird as best fitted for the performance of its functions in production.

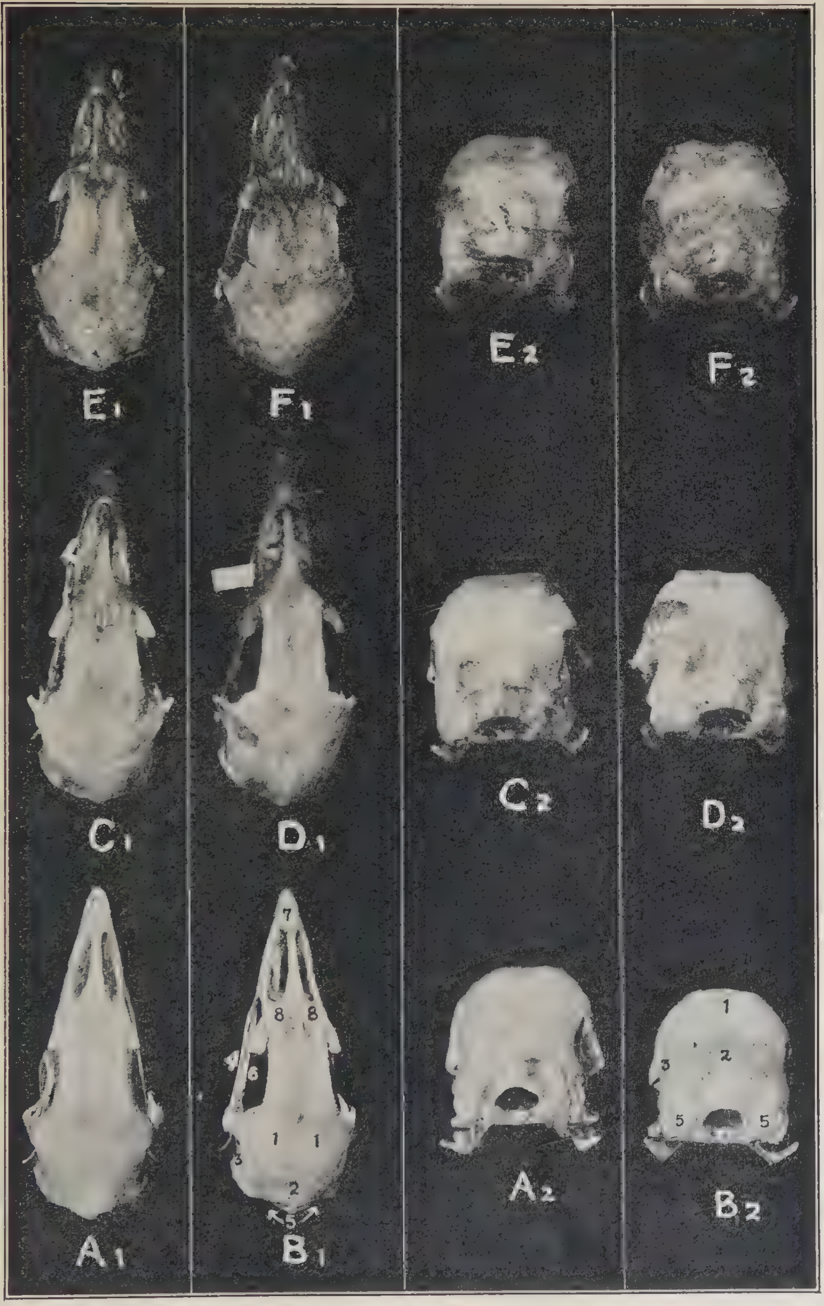

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FIG. 56.—The Skulls of Six Birds Showing Top and Rear Views. These Birds Varied Widely in Production.

*B*1: 1. frontal; 2. parietal; 3. temporal; 4. jugal bone; 5. occipital; 6. inferior jaw (lachrymal); 7. permaxilla; 8. nasal. *B*2: 1. frontal; 2. parietal; 3. temporal; 5. occipital.

The Kinds of Heads.—Roughly speaking, the characteristics of heads which are most generally associated with high egg production, as compared to low production values, may be defined as follows: The higher production types may be described as broad in front, flat on top, the width carried well back, as compared to a narrow front and rounded top when seen from the front, rear or side. The eye should be placed well in front of the head and near the top of the skull. These dimensions should be considered *relatively* as well as *actually*, that is, the relative proportions should be taken into consideration as well as the actual size of the head. This description, however, is too general to be applied accurately in estimating fine degrees of production. This is because there are too many exceptions to the rule and too many instances where the different measurements cannot be recognized on birds differing considerably in their production.

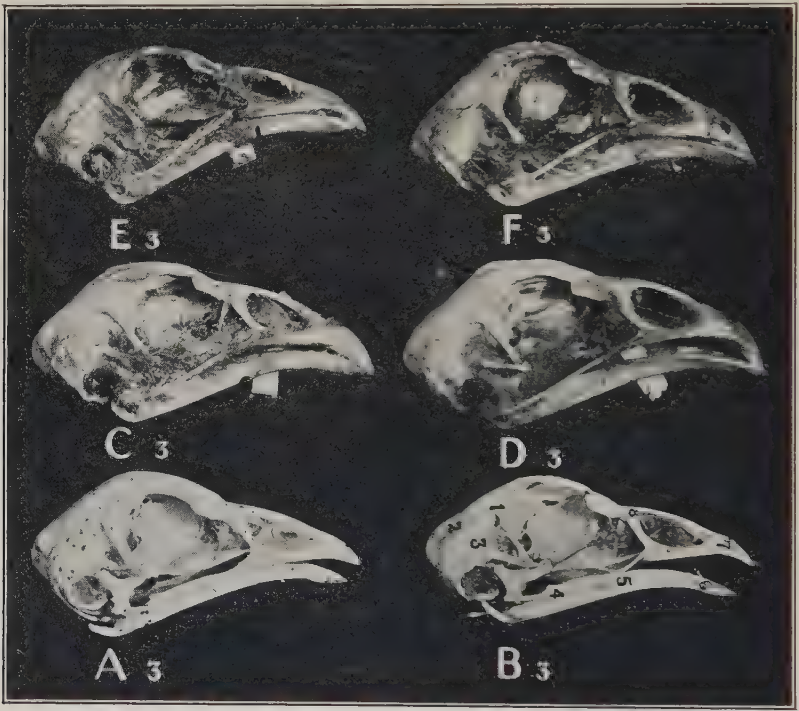


FIG. 57.—The Skulls of the Six Birds in Fig. 56, Showing a Side View.

B_3: 1. Frontal; 2. Parietal; 3. Temporal; 4. Quadrato-jugal; 5. Inferior maxilla; 6. Os dentale; 7. Permaxilla; 8. Nasal bone.

In order to secure the most accurate perspective of the size and shape of the heads of bird, when making comparisons, some focal point for measurement must be established. This point in the case of the fowl when viewed from the side appears to be the location of the eye. The dimensions of the head when viewed from the top (Fig. 56, left) front or rear (Fig. 56, right) or from the side, (Fig. 57) should be from the center of the visible area. These dimensions are best expressed actually or relatively by describing a circle about the head when viewed from the side with the eye as the center and this circle divided horizontally and vertically through the center, and at regular intervals, by parallel lines both horizontally and vertically. The same system can be used for comparing the heads when viewed from front, rear or above.

THE SKULLS OF BIRDS OF WIDE VARIATIONS IN PRODUCTION

Figs. 56 and 57 are reproductions of the skulls of six hens. These are lettered *A*, *B*, *C*, *D*, *E* and *F* respectively. The different views of the skull of the same hen are designated A_1, A_2 and A_3, etc. The contrasts in production of these six birds are: Hens *A* and *B* laid 303 eggs each; Hen *C* laid 185 eggs; hen *D*, 173 eggs; hen *E*, 78 eggs, and hen *F*, 109 eggs. The record for each hen was made during the first year of laying.

An exmination of the profiles of the skulls (Fig. 56) shows several differences. The reader, as a matter of interest, will be able to discover these for himself. The following differences may be seen:

1. The skulls of the three highest producing birds are smaller than those of the low-producing hens.
2. The bridge of the nose is more refined and the beak less arched, and the top of the head flatter in *A* and *B*.
3. The top of the head of the two lowest producers, *E* and *F*, appears shorter and higher than is the case in *A*, *B*, *C* and *D*.
4. No proportionate difference in the back portion of the skulls is apparent.
5. When viewed from the top heads *E* and *F* appear to be shorter and thicker proportionately.
6. No clearly defined differences can be detected when the skulls are viewed from the rear.

These studies of the skull are made purely to stimulate further investigation and under no circumstances are they to be considered as having positive or negative significance for or against the value of the skull as indicative of production quality.

These skull comparisons show quite clearly several slight differences in the types of heads which, if all other conditions were equal, and positive correlations between type of head and production were accurately determined, should give us quite a helpful key for estimating the production qualities of birds, insofar as they are influenced or determined by shape of skull indicating brain power. Many skull examinations must be made before accurate conclusions can be drawn.

The Brain in Relation to Production.—The big *if* which it is necessary to mention here is, *if* the *quality* of the " gray matter " were equal. This is the stumbling block in the science and art of phrenology whether applied to hens or people. How often do we see human " masterpieces " so far as the size and the shape of the head is concerned with a disappointingly low order of intelligence and sluggish energy as measured by scholarship, business ability or professional success. And how often have we seen positively brilliant persons who have scored low on size and shape of head. The same is true of the shapes of the heads of poultry as measuring their production. We secure the highest degree of brain power only when both the shape and the quality are correct.

The Thickness of the Skull.—The inside rather than the outside of the skull decides capacity. Here is another factor in estimating the size and shape of the brain which cannot be adequately measured or estimated in the live bird, namely, the thickness of the bones of the head in proportion to the size and shape of the brain cavity. This factor introduces an element of uncertainty when judging birds or people by head points, which seriously complicates the problem.

From the above it will be seen that when judging a bird's performance by the head we must consider three separate but closely related factors all having to do with the final judgment: (1) the shape, (2) the quality, (3) the quantity. The shape can be quite easily measured approximately by sight and touch or fairly accurately by the use of calipers. The quality of the brain (the gray matter) can best be gauged by the bird's appearance as shown by expression and actions. Third, the quantity can be surmised only by comparing the size of the head and the coarseness or fineness of the bones in other parts of the body and of the skin—as size and shape of shanks, size and shape of the scales on the shanks, coarseness of the skin, etc., as correlated with thickness of the skull. Fortunately, for the poultry judge, we have the great law of " correlation of parts " for guidance. There is a distinct harmony in the similarity of the structure of bones in all of the sections of the body. If they are heavy and coarse in one part, they are proportionately so in other parts of the same bird. Hence, the bones of the shanks, for example, would reflect the quality of the bones in the head, the thickness of which we could not measure without killing the bird.

The size of the brain, though presumably having value physiologically, as influencing production, cannot be measured accurately in the living bird. Nevertheless it is interesting to know the results of some attemps to ascertain the differences in size and shape of brains of birds varying considerably in production.

A limited amount of data regarding the brain weight of hens of different intensity and annual egg production are shown in Table 9, by Hall (1926). These figures do not reveal any appreciable difference in weight of brain that might not be accounted for by the size of bird or other factors. The only conclusion which can be drawn from these data is that whatever differences there may be in brain development, as influencing production, apparently are due to the quality or the shape of the convolutions of the brain rather than to the weight. The brain weight did not vary with weight of bird. The contrast in the weight of the birds from the lightest to the heaviest and the small number of birds involved do not provide sufficient data to justify conclusions when so small an object, relatively, as the brain is under consideration.

TABLE 9

AVERAGE PRODUCTION, INTENSITY, CYCLE, NUMBER OF CYCLES, AND AVERAGE WEIGHTS OF BRAINS OF FOUR GROUPS OF S. C. W. LEGHORNS, TWENTY BIRDS IN EACH GROUP

Group	Production	Average Annual Intensity	Number of Cycles	Average Cycles	Weight of Bird, Grams	Weight of Brain, Grams
1	112.4	49.1	72.9	1.57	1815.7	3.11
2	139.4	56.3	77.8	1.77	1725.0	3.15
3	160.1	62.6	81.3	1.97	1647.2	3.17
4	190.4	68.0	80.0	2.35	1698.2	3.16

Figs. 58 and 59 show x-ray exposures of several heads. In an attempt to penetrate beneath the surface of the head in order to learn the location of the lobes of the brain with reference to the sections of the skull and the thickness of the bony structure a considerable number of x-ray exposures were made of high- and low-line pullets, hens and cocks. The plates were made by a well-known authority in x-ray photography, Dr. Ramsey Spillman.

Two females of high-line breeding *b* and *c* and two of low-line breeding *e* and *f*, are shown in Figs. 58 and 59. *a* and *d* are exposures of the underside of the head through the jaw bones, which cloud the view of the brain. The side views, however, are quite informative with regard to the location of the outer lobes of the brain and the sections of the skull. These will be more easily located if the reader will

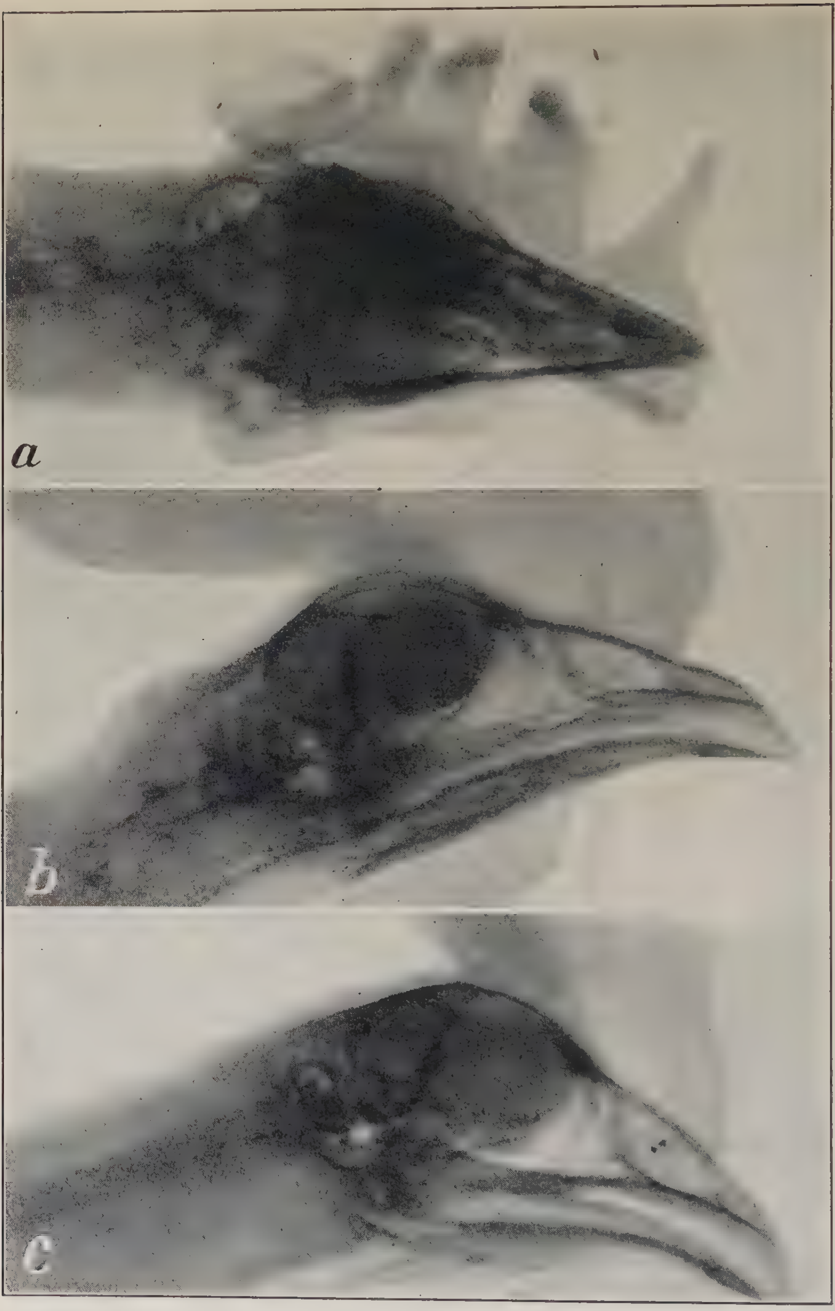


FIG. 58.—X-ray Views of the Heads of High Line Birds.

a is the bottom view and *b* the side view of S 4452, record of 278 eggs in her first laying year. *c* is the side view of N 3290. This bird had a five-year record of 225, 207, 200, 195, and 177 eggs, respectively.

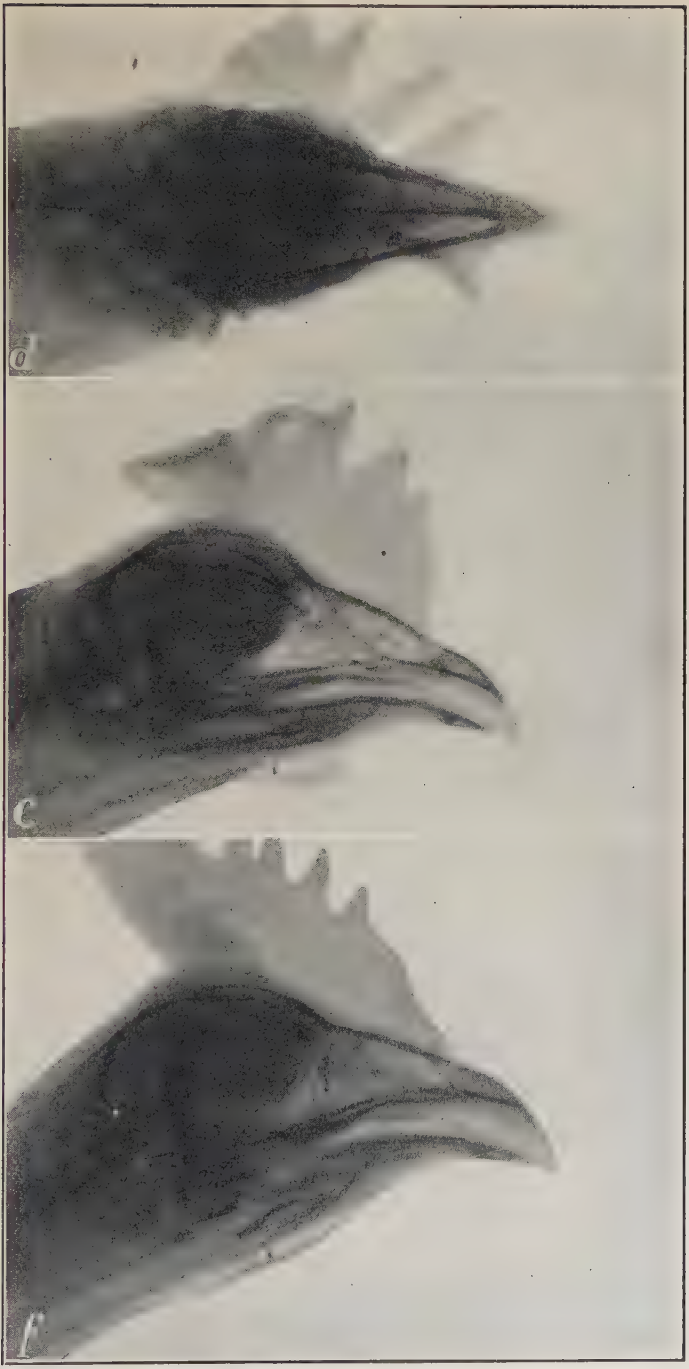


FIG. 59.—X-ray Views of the Heads of Low Line Birds.

d is the bottom view and *e* the side view of T 2449. This pullet laid 25 eggs by April 26 of her first laying year. *f* shows a side view of P 1897. This bird has a three-year record of 96, 88, and 95 eggs, respectively.

first note the parts of the skull and brain as shown in Fig. 60. The dark lines mark the areas where sections of the skull come together in a horizontal plane to the eye which usually also mark the fissures where the lobes of the brain come together. One is impressed with the size of the eye, the eye socket and the optic lobe. It is important, and possibly surprising too, to realize that the brain is not located ventral (above) but dorsal (back) of the eye. Here, as shown in Fig. 62, the thickest portion of the skull is at the most vulnerable points to protect the brain from injury from above, from the side or the front.

The attachment of the comb to the head shows that in case of *b* (high producers) and *f* (low producers) the point of rear attachment is well back of the eye, whereas in *c* (high producers) and *e* (low producers) it is directly over the eye. In the case of all of the birds shown the front attachment of the comb is directly over the front of the nasal opening. Presumably the location of the comb does not have any particular significance.

Comparing the outline of the tops of the heads and beaks, those in *B* and *C* (high producers) would appear to be a trifle flatter than in *E* and *F* (low producers). (Fig. 57.) No conclusions are offered regarding the relationships of type of skull or brain as indicating the production value of birds insofar as shown by the x-ray views of the four birds studied. Similar and far more detailed studies must be made on a larger number of birds of widely different production values before conclusions would be justified.

Although no significant differences were observed, according to our limited knowledge of interpretation, either in the size or shape of the brains or the skulls, the illustrations (Figs. 57 and 58) show quite clearly several variations in size, shape and thickness of the skulls which suggest the possibilities for further investigation.

What Lobe of the Brain Governs Reproduction?—There is still another complication in judging birds by the shape of the skull. It has not yet been definitely proven with poultry just what lobe or convolution of the brain is responsible for the stimulus of the act of procreation. Certain it is that there is such a stimulus based on the power of suggestion. This is proven by common observation of the mating of fowls. It is manifested in the pairing of birds at mating time and preference of individuals in the case of polygamous species. It is most conspicuously shown by the mutual mating receptivity of male and female in the case of the domestic fowl late in the afternoon, when about three-fourths of the daily matings normally take place. This being the time, presumably, when the oviduct is most free from obstruction, on account of egg formation, to the passage of the sperms of the male to the upper part of the oviduct when the egg yolk falls from the follicle into the enveloping funnel of the oviduct, at which point the fertilization most readily takes place by the female cell uniting with the male cell, the sperm.

The " urge to lay " is the impulse to egg production. Though a hen presumably does not " will to lay or not to lay," there are forces within and conditions without the body which, synchronizing together, result in egg production. The forces from within are the inherited tendencies involving the reproductive system and all the supporting organs of digestion, assimilation, circulation, etc., and each of these functions with the brain. The forces from without the bird are all the environmental conditions such as food, sunshine, temperature, the air, and the birds with whom they are associated.

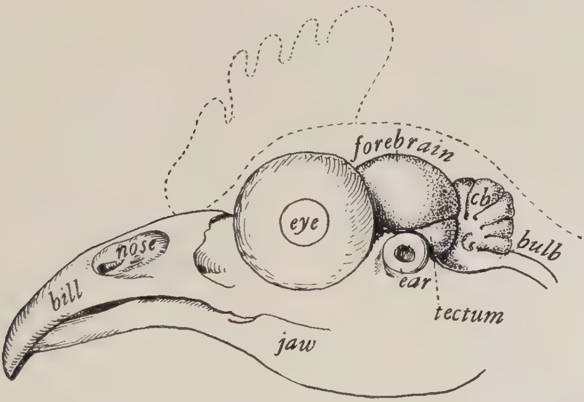


Fig. 60.—A Side View of the Skull and Brain of a Fowl.
Drawn by Dr. Papez of the Cornell Medical College.

The senses of sight, sound, smell, hearing, touch, all have their responses in appetite, fear, courage, happiness, revenge and sex response. Hence it would appear plausible that the quality of certain parts of the brain would be largely responsible for the excitation and activation of the reproductive system through suggestion.

A typical side view of the skull, brain and principal organs of the head is shown in Fig. 60, drawn by Dr. Papez of the Cornell Medical College. Observe the large proportion of the head occupied by the eyeball situated in front of the brain. Note the heavy skull bone like an armor plate above the eye and brain.

A more comprehensive and detailed view of the brain of the fowl can be seen from the under side (ventral), as shown in Fig. 61. The striking lesson to be learned from this clear drawing of the brain is its similarity to a telephone switchboard. It will be seen that each of the nerves branching off from the abducens nerve (*ab*) is a branch line which controls an important organ. The thinking and reasoning part of the brain in the fowl is in front and on top of the forebrain, the cerebrum, and consists of a very narrow portion, whereas in man this portion of the brain constitutes the largest part.

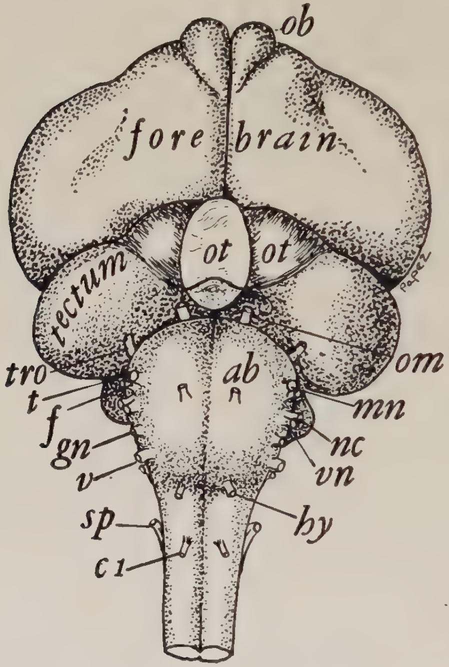


Fig. 61.—Ventral View of the Brain of the Fowl.

Drawn by Dr. Papez of the Cornell Medical College. Key: *ot*—optic tract; *ab*—abducens nerve; *tro*—trochlear nucleus or nerve; *t*—trigminal nerve; *f*—facial nerve; *gn*—glossopharyngeal nerve; *v*—vagus nerve; *sp*—spinal part of the spinal accessory nerve; *ci*—cervical nerve; *ob*—olfactory bulb; *om*—oculomotor nerve; *mn*—masticator nucleus or nerve; *nc*—cochlear nerve; *vn*—vestibular nerve; *hy*—hypoglossal nerve.

Fig. 62 shows the skull of a hen bisected lengthwise and the eye and the brain removed. The portion marked *f* is the region of the forebrain or cerebrum; *cb* is the cerebellum; *t*, tectum; *m*, medulla oblongata; *e* marks the place of the ear; *eye* shows a portion of the thin wall of bone which forms a partition between the eyeballs; *n* is the nasal opening. Compare with Figs. 60 and 61.

It is evident that it is difficult to prove just what part of the brain is responsible for activating the reproductive system. Perhaps at some future time scientific research will reveal the secret and show how the knowledge may be applied more accurately through studying the size and shape of the skull. For the present it is certain that more accurate judgment of the production quality of birds may be had by noting in addition to the shape the many other factors which the head reveals. Just what particular part of the brain is chiefly responsible, what is the seat of the reproductive response, has been the object of conjecture of phrenologists for centuries. The answer is not attempted here.

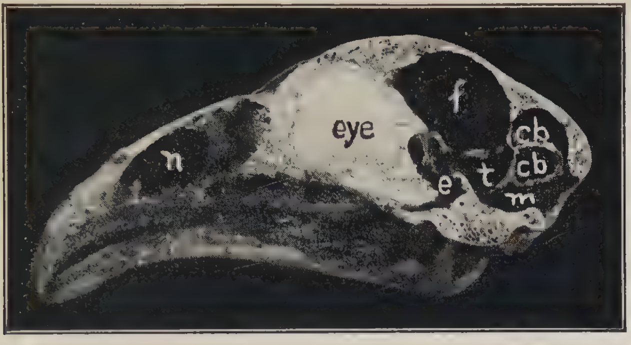


FIG. 62.—The Right Half of the Skull of a Hen Viewed from the Inside. Compare With Fig. 69.

DESCRIPTIVE CLASSIFICATION OF THE PARTS OF THE HEAD

The composite character of the head is clearly revealed when it is examined in detail, section by section, and function by function. An attempt at such an analysis with descriptive terms is here shown. It should be studied carefully and used freely when comparing birds. It focuses the attention upon each section. When the record is carefully made of the characteristics of each bird according to the descriptive terms, it furnishes a comprehensive detailed record to be preserved and compared with similar record or records made of the same bird or of different birds at other times of the year.

The physical characters indicating egg and meat production and vitality values as applied to the domestic fowl and the terms to describe them are shown in the following copy of stencil 5549 prepared for use in a poultry research project in 1927, at the New York State College of Agriculture at Cornell University.

The outline here reproduced was the result of considerable previous study of the head in old and young birds of each sex and of many types and degrees of quality. The classification is reproduced here in the hope that other students of the head characters may use it to increase further their knowledge of this important section of the bird.

Head Feathering.—The feathers of the head have the same significance as the plumage of the other parts of the body. They, like the feathers of the neck, are molted first. It would appear true that heavily laying hens are more likely to become baldheaded than are the poor producers. In explanation of this occurrence it has been asserted that baldness is due to the following causes. (1) The highest producers are laying so heavily and maintaining their unmolted plumage that less nutriment is available for growing new feathers on the head. (2)

THE HEAD

GENERAL CLASSIFICATION:

1. Rugged refined
2. Refined
3. Overly refined
4. Crow headed
5. Coarse
6. Phlegmatic
7. Masculine

I. SKULL.
- (*a*) Size (capacity)
  1. Large
  2. Medium
  3. Small
  4. Oversize
- (*b*) Shape front
  1. Broad
  2. Medium
  3. Narrow
- (*c*) Shape Side
  1. Round
  2. Medium
  3. Long
  4. Flat

II. HEAD FEATHERING.
1. Bald
2. Slightly bald
3. Not bald

III. BEAK.
- (*a*) Size (3 dimensions)
  1. Large
  2. Medium
  3. Small
- (*b*) Shape of beak
  1. Curved
  2. Medium
  3. Flat
- (*c*) Color of beak
  1. Bleached
  2. Pale
  3. Lightly pigmented
  4. Highly pigmented
  5. Orange
  6. Variegated

IV. COMB AND WATTLES.
- (*a*) Size
  1. Large
  2. Medium
  3. Small
- (*b*) Shape
  1. Lopped
  2. Slightly lopped
  3. Straight
  4. Limp
- (*c*) Angle Rear Blade
  1. Low
  2. Horizontal
  3. High
- (*d*) Points Length
  1. Short
  2. Medium
  3. Long
- (*e*) Points Thickness
  1. Thick
  2. Medium
  3. Thin
- (*f*) Thickness Base
  1. Thick
  2. Medium
  3. Thin
- (*g*) Color
  1. Bright red
  2. Medium red
  3. Yellowish red
  4. Dark red
  5. Purple
  6. Pale
- (*h*) Texture
  1. Waxy, soft and velvety
  2. Smooth
  3. Rough
  4. Dry
  5. Hard and scaly
- (*i*) Temperature
  1. Hot
  2. Warm
  3. Cold

V. FACE.
- (*a*) Condition of Face
  1. Full
  2. Slightly sunken
  3. Badly sunken
  4. Fat
- (*b*) Color of Face
  1. Red
  2. Medium
  3. Pale
  4. Yellow
- (*c*) Feathering
  1. Free
  2. Slight
  3. Medium
  4. Heavy

VI. EYE.
- (*a*) Position
  1. Prominent
  2. Full
  3. Sunken
- (*b*) Shape Eye
  1. Round
  2. Oval
  3. Drooping
  4. Overhanging
  5. Slanting
  6. Crosseyed
- (*c*) Size
  1. Large
  2. Medium
  3. Small
- (*d*) Color
  1. Dark bay
  2. Light bay
  3. Gray
  4. Pearl

VII. MENTALITY.
- (*a*) Expression
  1. Snappy (challenging)
  2. Alert
  3. Sleepy
  4. Dull
  5. Dopey
- (*b*) Disposition
  1. Friendly
  2. Docile
  3. Neutral
  4. Quarrelsome
  5. Flighty
- (*c*) Intelligence
  1. Inquisitive
  2. Bright
  3. Indifferent
  4. Stupid

Another theory is that the feathers have been broken off in mating and have not been renewed. (3) Still another reason suggested is that the blood circulation is less rapid on top of the head than in other parts of the body. The first is generally accepted as the most plausible. The second hardly seems justified and the third does not have a sound physiological basis of fact.

The Beak.—The beak, being a part of the bony structure of the head, must be judged with it since its size, color, and attachment to the skull have much to do with the general appearance of the head.

The significance of the beak in judging depends primarily upon its shape and color. In this respect it may be used as a reflection of the physical condition of the bird based on the correlation of parts of any particular species. Each species of birds is in a class by itself as regards shape of beak. For example, a long, flat, thin beak, as compared to a short, heavy, curved beak, could not be used as indicating high or low production or high or low vitality in all species of birds. The crow, with a flat beak and the hawk with a curved beak would, in their natural state of vigor, no doubt, represent similar degrees of vitality and production. The philosophy that the long, flat thin beak is indicative of lower vitality and presumably lower production than in the case of the same species of poultry having a heavy, well-curved beak, is based on the belief, which appears to be borne out by observation, that the domestic fowl when suffering on account of improper feeding or the ravages of disease or parasites will be likely to show the effects in certain types of abnormalities in growth. These usually are manifested as a result of low vitality and not as the cause of low vitality, in an elongation of the head and beak, shanks and toes, out of proportion to the other parts of the body. (Fig. 24.) Inherited, as well as acquired, weakness also apparently manifests the fact in a similar manner, as regards the shape of the beak.

Appearances are often deceptive. When considering the shape of the beak and head, the influence of the change of shape and size of the comb may be deceptive as influencing the judgment of the appearance of the head as a whole. The reader, in order to observe this relationship, is advised to make drawings of the heads of birds and to note how a change in the size and shape of comb will greatly affect the judgment of the shape of the head and beak.

The changing color of the beak due to the influence of production and food supply is one of the most valuable sections of the body for observing pigmentation.

The Comb.—Reproductive efficiency is best shown by the comb. The past, present or future production is shown by the comb condition.

The comb dries down and the scurf peels off and it becomes cold when the bird is dormant; it becomes warm, showing red crevices when it expands and later crimson red over the entire surface when production begins. Present and future production, therefore, is easily shown by the comb and wattles.

The size and type of the comb are determined by the poultry breeders. The comb may be bred large or small, with high or low rear blade or spike, straight or lopped, rose or single, as a variety characteristic, and it has no apparent influence on the number of eggs laid by a bird. It then becomes purely a unit character, the same as the ovary would be a single unit character, and the two are not necessarily inherited together. However, as between birds of the same variety or strain of individuals, those which are in production have larger combs than those which are dormant. It would appear also that, if left to natural development without selection by man with reference to size or shape of comb, the combs of higher producers might be expected to be slightly larger than those of the low producers of the same variety and strain.

The comb, therefore, may be looked upon as a secondary sexual character which reflects in its color, size and texture and temperature the condition of the reproductive system and this in turn indicates the general health of the bird.

The shape of the comb, likewise, apparently has a variety significance only. It apparently indicates the productivity of the bird only insofar as the texture reflects refinement and warmth and the fullness shows health and activity of the reproductvie system. In its normal condition it merely represents the idea or fancy of the breeder. The only exception to the above which appears to be well founded, is that in very low or degenerate condition of birds, there appears to be a reversion toward the primitive forms of small comb. The number, size and shape of the points of the comb seem to have some significance. The broad, flat points are generally considered to be associated with better body types and higher vitality than the so-called narrow, pencil points. (Fig. 2.) The thickness of the comb is important. The very thin, limp combs with a narrow base indicates too much refinement and the thick, leathery combs are associated with too much coarseness. The best comb is one that has a good broad attachment to the head but is not carried too stiff.

Pictures of the original species of the wild jungle fowl, Gallus Bankiva, as shown in Figs. 1 and 2, illustrate the appearance of the progenitors of all or most of our domestic fowls. Note the high rear blades, then compare these small combs of some of the degenerate types as the result of inbreeding and the exhibition types as bred by some of the fanciers, and as contrasted with the other extreme, the ponderous combs of some of the English Utility Leghorns, which are much too large as some of the American types are too small.

The size of the comb, it would seem, should not be of either extreme, and the shape should be such as to best meet the requirements of beauty and utility. The main fact to consider here is the fallacy of breeding for a single character without regard to whether or not the bird possesses high production. To select any breed for any character or combination of characters, whether that is the comb, head or body, in order to increase production instead of selecting birds on account of their production, is getting the cart before the horse and the horse faced backward.

It would seem certain that we will see the style of the small, high, rear blade, comb type of the exhibition Leghorns change. It is not correctly correlated with a large capacity body.

A desirable comb should have smooth texture; a thick base; short, regular shaped points; medium-sized blade well adapted for cold-weather conditions; and the rear blade horizontal or following the neck to meet the demands of symmetry or outline of the bird. The same principle would apply to all breeds, except that with the general purpose breeds the combs have been bred less conspicuous and hence are not involved to the same extent as with the Mediterranean breeds.

The temperature of the comb varies with the reproductive condition. It is warmest when birds are just commencing to lay and is coldest when the bird is dormant.

The texture of the comb and wattles is the most conspicuous part of the body to ascertain the texture of the skin. It varies in texture from velvety, glossy fineness to an extremely thick, pebbly condition. Neither extreme is to be desired. If it is too fine the bird may show too much refinement bordering on weakness. If it is too rough the bird is likely to be too coarse in all parts of the body for the most efficient production.

The color of the comb is so variable depending upon the physical condition of the bird that it is the conspicuous and most reliable indication of health and reproductive activity. The comb colors arrayed in the order of the health values are from bright red to dark red and purple and the opposite extreme in color. Pale purple indicates thick blood and slow heart action and paleness is the certain symptom of weakness.

The Face.—The face is valuable as indicating ill health by its bloated, sunken or emaciated condition. Any of these conditions is a sign of weakness. The smooth, full, red face is the ideal condition indicating good health. Face feathering is objectionable on account of appearance and may be associated with heavy feathering in other parts of the body, which it is believed, is correlated with low production.

The Eye.—The eye is the most important single character of the head and perhaps of the bird. It should be considered with respect to four principal qualities, each one of which has an important bearing on health and production.

The eye has the distinction of having the largest lobe of the brain to support it. The eyes are so placed in the front part of the head that they serve as the searchlight and conning tower combined. They guide the entire ship. It is not surprising to find, therefore, that the eyes are the windows through which the judge may look at the interior of the bird.

The position of the eye as to its prominence indicates the condition of the supporting muscles. Therefore the eyes should be prominent and not sunken. The shape is determined principally by the eyelid and eyebrow. The open eye shows health. The drooping eyelid indicates a lack of vitality. The cross-eyed bird has eyes that focus on the beak instead of straight ahead or at right angles to the head. This condition is a deformity and usually is found in a narrow head.

The size of the eye is responsible principally for its prominence. The size and prominence are best observed when the head is viewed from the front or rear, from which position the convexity of the eyeballs may be seen. When viewed from the side the best type of eye is wide open and approximately round. The prominence of the eye is indicated also by the appearance of the edge of the inner eyelid which is scarcely visible in a sunken eye.

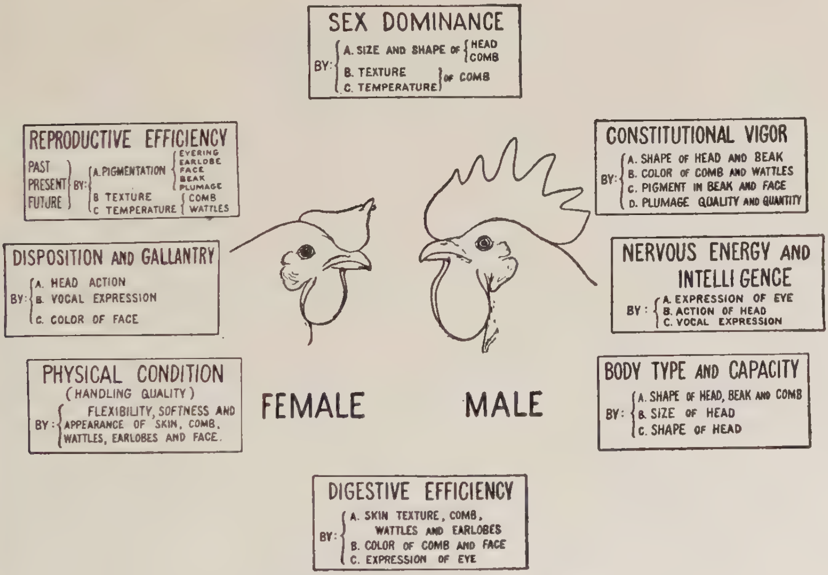
The color of the iris of the eye is similar to other pigment sections of the body in that it is somewhat variable, retaining its bright luster in birds having the largest amount of reserve vitality. When the vitality of a bird is sapped by parasites or disease the iris of the eye may become a bright gray color.

Mentality.—It is the sparkle and flash, the challenge of the eye, which is responsible for expression. This in turn reflects the mental response so closely associated with high production. The action of the head and the speed of blinking the eyes are reflexes of the mental condition which reveal nervous energy and intelligence. The birds having bright, alert expressions are in violent contrast to the sleepy, dull individuals. The disposition of birds reflects their ancient origin or their modern development. The most undesirable types retain their original flighty, quarrelsome dispositions, whereas the most highly developed types are friendly and docile.

The Intelligence.—The intelligence of birds may be defined as inquisitive, curious, bright and alert as compared to the indifferent or even stupid individuals. Just how much reasoning power is possessed by the highest producers as compared to the lowest producers has not been worked out by psychological tests, but it is already apparent to those who have handled many birds in trapnests that the highest producers do differ materially from the lowest producers in those mental traits which are manifested by actions here discussed under the term "mentality."

The Characters and Functions of the Head

In an attempt to bring together the characters of the head in relation to their various functions Fig. 63 has been drawn. The border line between characters and functions frequently is not very clearly drawn and sometimes is debatable.


SEX DOMINANCE
BY: A. SIZE AND SHAPE OF HEAD, COMB
B. TEXTURE, C. TEMPERATURE OF COMB
REPRODUCTIVE EFFICIENCY
PAST, PRESENT, FUTURE BY: A. PIGMENTATION EYERING, EARLOBE, FACE, BEAK, PLUMAGE
B TEXTURE, C TEMPERATURE COMB, WATTLES
CONSTITUTIONAL VIGOR
BY: A. SHAPE OF HEAD AND BEAK
B. COLOR OF COMB AND WATTLES
C. PIGMENT IN BEAK AND FACE
D. PLUMAGE QUALITY AND QUANTITY
DISPOSITION AND GALLANTRY
BY: A. HEAD ACTION
B. VOCAL EXPRESSION
C. COLOR OF FACE
NERVOUS ENERGY AND INTELLIGENCE
BY: A. EXPRESSION OF EYE
B. ACTION OF HEAD
C. VOCAL EXPRESSION
PHYSICAL CONDITION
(HANDLING QUALITY)
BY: FLEXIBILITY, SOFTNESS AND APPEARANCE OF SKIN, COMB, WATTLES, EARLOBES AND FACE.
FEMALE
MALE
BODY TYPE AND CAPACITY
BY: A. SHAPE OF HEAD, BEAK AND COMB
B. SIZE OF HEAD
C. SHAPE OF HEAD
DIGESTIVE EFFICIENCY
BY: A. SKIN TEXTURE, COMB, WATTLES AND EARLOBES
B. COLOR OF COMB AND FACE
C. EXPRESSION OF EYE

Courtesy Poultry Department, Cornell University.

Fig. 63.—The Characters and Functions of the Head.

Under each of the eight groups of functions are shown the particular characters which best indicate the functional activity of the bird under different conditions of vitality, age and production for each of the sexes. For example, starting with constitutional vigor, it is believed that the shape of the head and beak, the color of the comb and wattles, the pigment in the beak and face, and the plumage both as to quantity and quality, will best reveal the vitality of the bird. By moving " clockwise " in studying Fig. 63 to nervous energy, body type, digestive efficiency, physical condition, disposition, reproductive efficiency, and sex dominance, a careful examination of many birds with book in hand and the descriptive classification of the parts of the head (page 138) to record the observations, one should be able to master the science and art of reading the language of the head. The more one studies the heads of birds the more he will come to spell constitutional vigor, nervous energy, and sex dominance in capital letters.

Early Attempts to Describe, Classify and Define the Head Types as Indicative of Production Value

Many attempts have been made to describe and classify the types of heads of the domestic fowl as indicating their production. Each attempt has added to the sum total of knowledge, but no one, it may be fairly said, has succeeded in standardizing the information into a perfectly working system. This is no reflection on the value of the several important contributions that have been made. The reason for the lack of a perfectly working plan for judging by head points is the comparative newness of the proven facts upon which to base a perfect system. Such a system is not possible until after sufficient scientific research has been conducted.

A brief summary of the progress in judging by head points follows. Further light on the history of judging by physical examination no doubt will reveal many other definite contributions.

In 1918 the Cornell Poultry Judging School approved a descriptive statement of the difference between the head of a high-producing and a low-producing fowl as follows: " One of the finer indications, but yet one of the most valuable in picking the high layer is the fineness of the head and the closeness and dryness of feathering. The head of a high layer is fine. The wattles and earlobes fit close to the beak and are not loose and flabby. The face is clean cut. The eye is full, round and prominent, especially when seen from the front. The high layer is trimmer, that is, the feathers lie closer to the body and after heavy production the oil does not keep the plumage relatively as sleek and glossy but the plumage becomes worn and threadbare.

Changes in the Secondary Sexual Characters

The comb, wattles and earlobes enlarge or contract, depending on the ovary. If the comb, wattles and earlobes are large, full and smooth, or hard and waxy, the bird is laying heavily. If the comb is limp the bird is only laying slightly but is not laying at all when the comb is dried down, especially at molting time. If the comb is warm it is an indication that the bird is coming back into production."

Terminology Used by Foreman, 1919, in Describing Heads

Foreman, 1919, gave a detailed description of head characters in which he described several head types. "Egg type in poultry is more reliably indicated by the head than any other single part of the body. The head reveals health, constitutional vigor, age, refinement, coarseness and masculinity." The following quotations are descriptive legends used in describing several birds with distinctly different head types.

"Lady Activity, 263 egg record in 365 days. Note the keen, refined, intelligent expression in this heavy producer—large, bright eye; narrow skull; clean-cut face, possessing femininity and vitality. This hen was selected by refinement of the head as the record hen in the College flock in 1916 just as she began to lay."

"Miss I. W. W., a lazy disposition. A coarse head is characteristic of unprofitable layers. Older hens taking on fat will also show this coarse, broad skull, wrinkled face, china eye and dull inactive expression."

"Miss Chuckle Head is a zero producer. Note the masculinity expressed in this individual by long wattles, gouty face and coarse comb. This is a typical head of a hen that has developed permanent atrophy of the ovary. She never has nor never will produce an egg. This type is not common."

"This head shows extreme refinement. Care and judgment must be exercised or refinement of the head will lead to selection of individuals that are not sufficiently robust to stand up under the continuous strain of heavy egg production. Small heads and extreme fineness of features generally indicate a propensity for broodiness."

"Crow Head. Note the long, straight, narrow beak and sunken eye. This is an undesirable type readily developing colds and disease and is constitutionally a poor producer."

Payne, 1922, devoted considerable attention to the head as here quoted: "A lean, clean-cut face with prominent, clear eyes, and an absence of wrinkled skin about the head is a mark of good quality." "Poor layers usually show a beefy head, full face, heavy eyelids and eyebrows, and round shanks covered with rather coarse scales." "Heavy, overhanging eyebrows, and a lack of luster throughout the head, comb and wattles are further indications of broodiness."

The Foreman Classification of Head Types.—At the Cornell Poultry Judging School, in 1924, Foreman wrote the following description of the head of a high producer as compared to that of a low producer, which was incorporated as a part of the annual statement made by a committee and voted upon by the entire staff.

The High Producer.—"The head should be of medium length and depth, with strong impressive lines. The face should be full with a bright, intelligent, friendly and expressive eye, indicating a sensitive and responsive nervous organization. The skull should be wide and flat, the width increasing uniformly from the attachment of the beak to a point directly back of the eye. A smooth and lean condition of the skin covering the face is desirable. The head should be neatly attached to the neck, avoiding all tendency toward throatiness."

The Low Producer.—"Thick, prominent jaws, narrow skulls, heavily wrinkled or shallow faces, small or sunken eyes, overhanging eyebrows, or combs with extremely narrow serrations are all undesirable."

On the same occasion Foreman gave the following description and classification of the head types. As general information for judging he stressed three essentials: (1) head character; (2) balance; (3) temperament. He further emphasized the importance of considering temperament in four categories which he defined as: (*a*) aggressive; (*b*) active; (*c*) flighty; (*d*) lymphatic. These he referred to as representing the (*a*) physical; (*b*) functional; (*c* and *d*) nervous and mental condition of the birds.

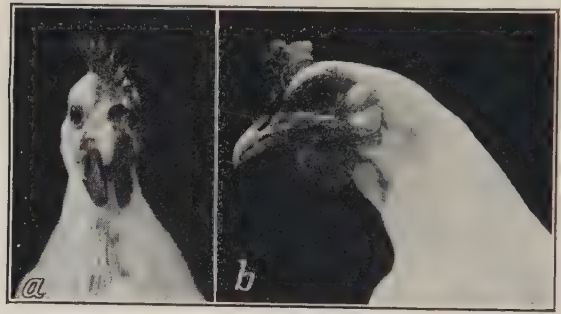


FIG. 64.—A Typical Crow-head.

The heads of fowls were further classified and described under six descriptive terms. These were: (1) crowheaded; (2) overly refined; (3) refined; (4) lacking in character; (5) beefy; (6) masculine.

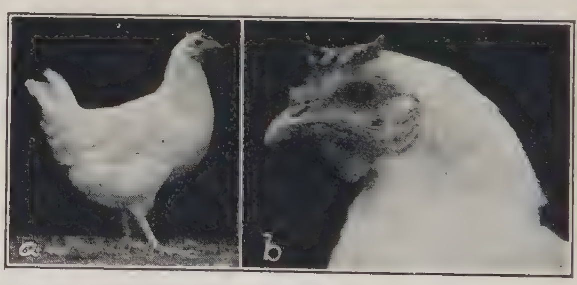


FIG. 65.—An Overly-refined Head.

This bird laid 193 eggs and stopped. She is out of production and molting. Note the shrunken comb, dull eye and feathered face. Weight, 3.8 lb.

No attempt was made by Foreman to give the estimated production ratings for the six classes. The distinctions which he made in describing the important characteristics of the classes of birds are given in detail.

1. *Crowheaded* (Fig. 64).—Long, shallow head, depressed face and sunken eye. A low vitality type; slow to mature, feather and lay.

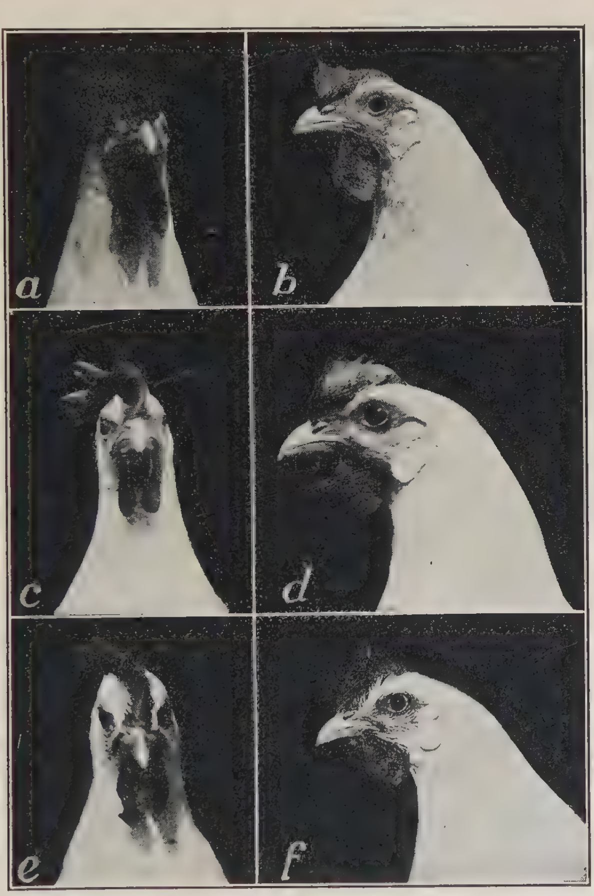


Fig. 66.—The Refined Head Type.

Three good hens but not outstanding individuals. They laid 202, 210 and 221 eggs, respectively. *d* has the most refinement in size and shape of head, cleanness of face and alertness of expression. The shape of the heads when viewed from the front or the side are quite similar and show good width and flatness. The eyes of each are prominent. The combs are waxy in texture, medium in size and well flexed and not limp. The third hen has a slightly coarser head refinement, is narrower, more round at the top. The comb is drier, harder and slightly coarser. The face is feathered. She is slowing down in production.

They are described as rangy and awkward. Their production would depend upon the degree of temperament to furnish the driving power. This abbreviated description by Foreman is generally accepted as describing the " crowhead " type.

2. *Overly Refined* (Fig. 65).—Small; highly sensitive and delicate; high-laying temperament; bright, active disposition and distinctly effeminate but lacking in robustness, vigor and weight to sustain high production. They lose pigment rapidly. This brief abstract from Foreman represents the generally accepted description of the overly refined grade.

3. *Refined* (Fig. 66).—This is Foreman's best grade. He defines the head and body as being in proper balance, and having a high quality of activity, energy and production. The face is of medium length and depth and the skin of fine texture and lean appearance. This shape of the head is described as of medium length and depth, with skull and jaw of the same width and thickness, which gives a full but flat appearance to the face when viewed from the front. The skull tapers uniformly to the beak from the rear of the eyes, where it reaches its greatest width. The skull is described as flat and level on top. The eye is located near the top of the skull and well to the rear of the face. This description by Foreman of recent date apparently agrees with Steup's head points for the high-producing hen except that Steup describes the location of the eye of the high producer "well toward the nostril under the front half of the comb."

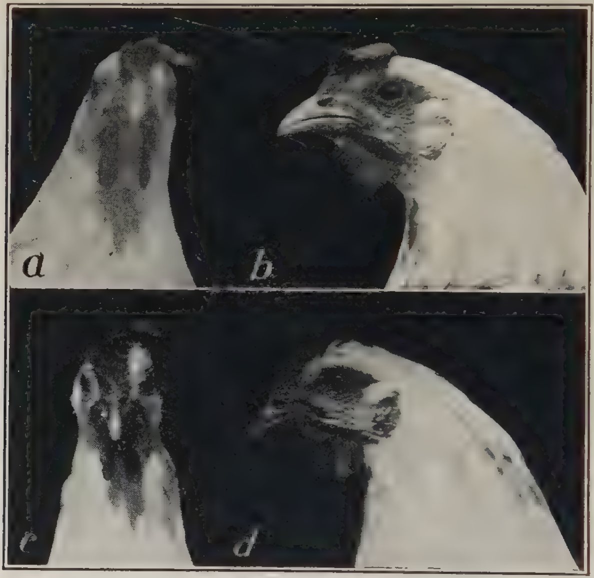


Fig. 67.—Heads of Birds Lacking Character.

a–b laid 44 eggs and *c–d* 34 eggs in one year. They are distinctly dull and sleepy. Each bird shows coarseness. Note the heavy jaw of *d*.

4. *Lacking in Character* (Fig. 67).—Foreman described this group as "having a distorted conformation of the head and an expression of negative character." It lacked nervous energy and proper proportion and balance. Such birds have dull eyes, listless expressions and are short season, low producers, slow to mature and they molt early.

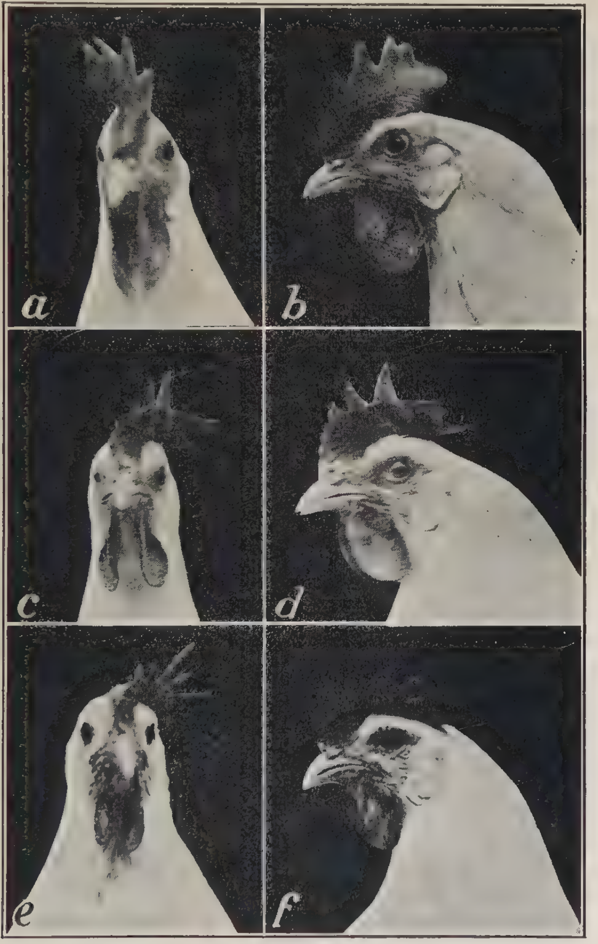


FIG. 68.—Three of a Kind, All "Coarse" Heads.

They laid from *a–b* to *e–f* 152, 153 and 149 eggs, respectively. Note the great strength of beak and heavy jaw but round, narrow heads on top. Each has feathers on the face.

5. *Beefy Head* (Fig. 68).—A short heavy head with heavy, coarse, rounded skull, jaw wider than the skull. The eye is located midway between the skull and jaw and is sunken, and such birds usually have

thick skins and are sluggish in temperament. The neck is short, stout and heavy, with a full throat. The actions are slow.

6. *Masculine Type* (Fig. 69).—This type, according Foreman, is the result of abnormality of the sex organs which materially alters the appearance of the secondary sexual characters. He mentions two distinct types of masculine birds. One shows the typical masculine type early in life and the other later in life. The first shows the effect of incomplete, early non-sexing. They carry high pigment in the various sections of the body, red combs and spurs; and other masculine characters such as sickle feathers, develop. The voice becomes coarse and masculine. Males treat these individuals as they would other males. The second class of masculine type hens shows the changes less distinctly.

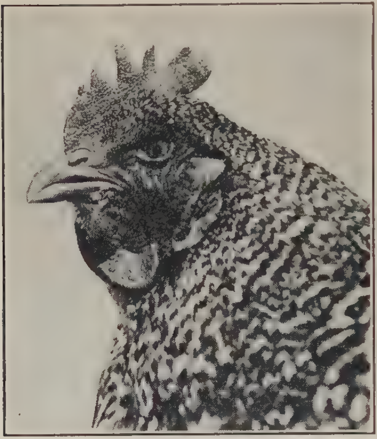


FIG. 69.—This Barred Plymouth Rock Hen Has Developed Masculine Characteristics.

Compare this head with the two White Leghorns shown in Fig. 72.

Foreman's very careful descriptions of the last five grades are clearly made and are accurate according to our present knowledge. Foreman's classification of head types does not cover a wide range of high quality birds. Five of the six types would be considered as below the average. This throws too many birds of many degrees of high quality into the refined class.

The Payne-Steup Kansas System for Judging by Head Points.—In 1929 Payne and Steup gave a comprehensive description of the shape of the head as a character indicating laying quality. While recognizing the value of other parts of the head in estimating egg production the claim was made that the shape alone was sufficient to form correct judgment of laying values.

The keystone of the claims for this system is based upon the head having fixed characters as distinguishable from the variable characters. It is claimed that since the skull characters do not change during the year or for life with any individual they may be observed accurately at all times and under all conditions. This fact, if true, certainly would be a great advantage. The four cornerstones of the system are: (1) " The flatness of the top of the skull from side to side "; (2) " The carry forward of the skull width "; (3) " Head balance," and (4)

" Levelness of the top of the skull both in front and behind the eyes." (Fig. 70.)

(1) The first factor, flatness of the top of the skull from side to side, when viewed from the front, is a reaffirmation of one of the early and frequent observations of the characteristics of the heads of high producing hens. This particular dimension is to be observed by looking at the bird from the front or rear, in which event a high producer would have a flat head and a poor producer would have a head high in the center and sloping toward the eyes. Coupled with the flatness of the skull it is claimed that the distance from the eye to the top of the skull is narrower in a high producer than it is in a low producer. This difference in distance is accounted for by the greater height of the center of the top of the head of a low producer, which, when viewed from the side, front or rear, would be arched. (Fig. 57.)

If it should be true that the head of the low producer is higher in the center above the eye it may possibly be due to the greater thickness of the skull bone at that point. If so, this would check with the common belief that low producers are coarse-boned, and if this is true we would expect thicker bones in the head as well as the shanks and other parts of the skeleton.

(2) The second character, " The carry forward of the skull width," implies in the higher producer a wider forehead and the location of the eye sockets farther forward. According to Steup, the eye of a high producer is " set well forward in the head, well under the front half of the comb, whereas poor producers have the eye sitting farther back under the rear half of the comb or else behind the comb entirely." This principle has been generally accepted for some time. It requires a keen eye to see the slight differences in the location of the eye with respect to the back and fore part of the head and comb attachments.

Great emphasis is placed in the Steup system upon the assertion that " Most skull widths taper and narrow right in front of the eye " and that the extremely good hens carry this width farther forward than do poor layers.

(3) Steup's third character, " head balance," emphasizes the comparative distance between the top of the head and the bottom of the jaw as measured by a vertical line drawn through the eye, as balanced by the distance from the front of the earlobe to the tip end of the beak as measured by a horizontal line drawn below the eye. (Fig. 70.)

(4) The fourth character is " levelness of the top of the skull both in front and behind the eye." It differs from his first character by having the slope of the head, front and back, from the top of the head when viewed from the side.

The distinction, according to this character, between the good and the poor producers is that the good hens have heads which when viewed from the side have a flat top line as compared with a steeper top line on top of the head of the poorer producer when the center of the head is directly above the eye. The angles may be compared to a flat gable roof representing the higher producer and the steep gable roof the lower producer.

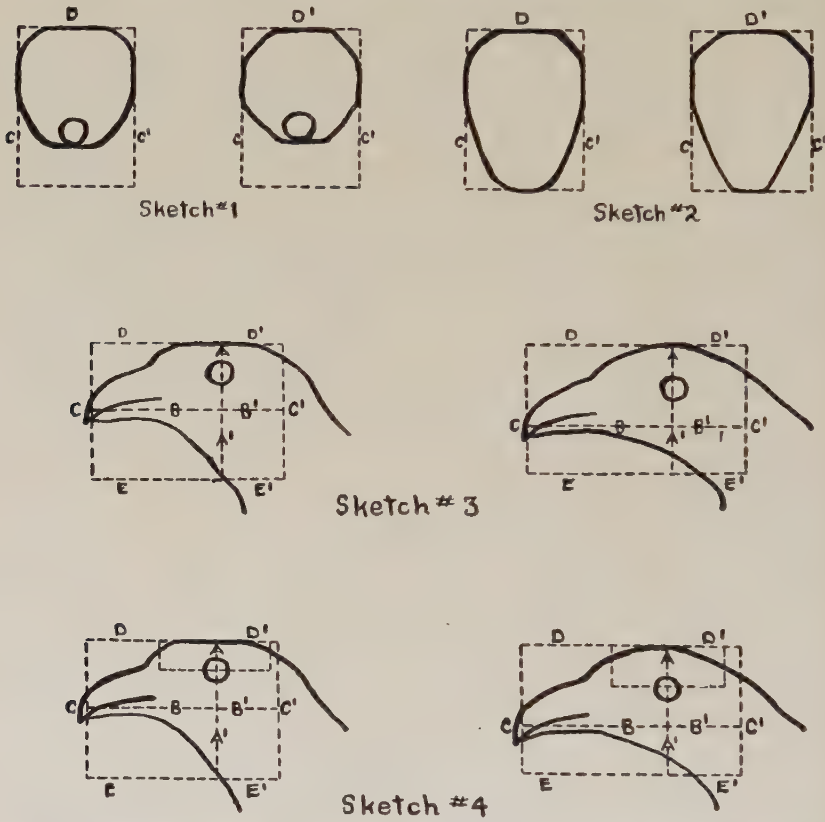


FIG. 70.—Sketches Showing the Various Measurements Used in the Steup-Kansas System of Judging Head Type.

Sketch No. 1 shows the character "flatness of top of skull from side to side" when viewed from either front or rear.

Sketch No. 2 shows the character "carry forward of the skull width" when viewed from above. D is the high and D^1 the low producer.

Sketch No. 3 shows the character "head balance" when viewed from the side. Left is the high producer and right the low producer.

Sketch No. 4 shows the character "levelness of the top of the skull" both in front of and behind the eye. Left is the high producer and right the low producer.

In order to bring out more graphically and clearly the four characters which Steup proposed, note Fig. 70 in which a few lines are used to show the exaggerated differences. Sketch 1 shows the " flatness of top of skull from side to side, when viewed from the front. Sketch 2 shows " carry forward of skull width " when viewed from the top. Sketch 3, " head balance " is viewed from the side. (In good layers, the vertical distance is nearly equal to the distance from the front of earlobe to the tip of the beak, whereas in poor layers the distance of the vertical line is much shorter than the horizontal line.) Sketch 4, " levelness of the top of the skull both in front of and behind the eye," is viewed from the side. This measurement is intended to distinguish the long " crow head " from the round, blocky head of the phlegmatic or masculine types.

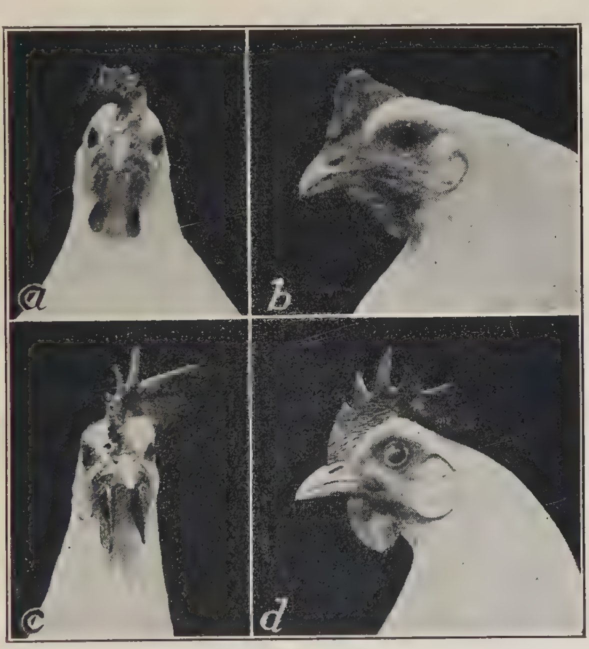


Fig. 71.—Two "Phlegmatic" Heads.

They laid from *a–b* to *c–d* 122 and 97 eggs, respectively. Note the very narrow, rounded top of head of *a–b* and the broad, flat head of *c–d*. These are in some respects opposite in type but similar in the slope of skull from the top of the head to the back. Each has dull eyes and a feathered face.

No attempt is made by Steup to estimate, even approximately, the number of eggs that the hens which meet the requirements of each of the four characters would lay as compared to the hens that do not. In ratings as to laying quality the birds are described as good or poor layers, or extremely good or extremely poor layers.

The Cornell University Classification of Head Types.—This is a composite system based on the ideas of many of the members of the teaching staff of the Annual Cornell Poultry Judging Schools, 1918 to 1929. Both Foreman, 1924, and Steup, 1929, presented their ideas at the Judging School and these ideas have been considered in this classification. It includes the results of many individual examinations of birds having a wide range of production, including several breeds and varieties, but principally White Leghorns. It retains the descriptive terms of Foreman's first three classes, namely: (1) refined; (2) overly refined, and (3) crowheaded. His next type (4) " beefy head," has been changed to " coarse," which falls in the unrefined group. His (5) " lacking in character " type has been replaced by " phlegmatic," and his (6) incomplete or " hermaphroditic," has been replaced by the word " masculine." The qualities of the birds included under all six grades remain essentially the same. The order in which Foreman

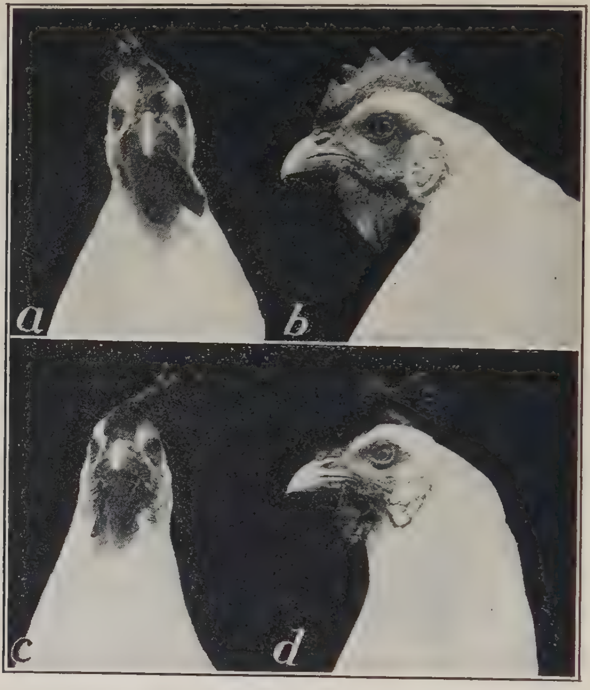


Fig. 72.—The "Masculine" Head Type.

The ovarian action is dead. The hens are physically strong but reproductively weak. Note the striking similarity in coarse, fatty condition of the face and "squinting" expression of the eye of both birds *b* and *d*. They do not lay.

named his head types has been rearranged according to quality, the highest to the lowest, in approximate production values.

The reasons for substituting the term "coarse" or (unrefined) is that "beefy" suggests a beef type or meat-producing animal, which is a misnomer when applied to a low grade of poultry, such as Foreman's (4th) head-type class. "Beef cattle" to be worthy of the term must have real meat production quality, requiring high vitality, strong nerve power and efficient digestion and assimilation. These qualities are all fundamental to efficient egg or milk or meat production. Hence, the common term "beefy head" should not be applied to the (4th) head type, which represents a "coarse" and distinctly unrefined, unresponsive individual.

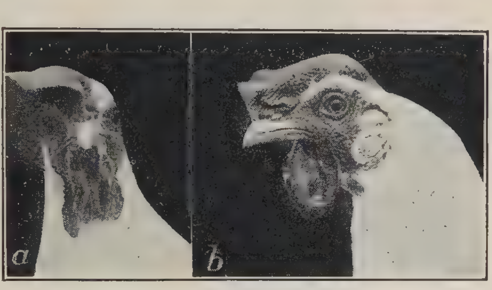


Fig. 73.—A Typical "Nester" Head.

An "internal" layer. A strong, rugged refined head showing vigor, intelligence, and alertness as indicated by shape of head and expression when viewed from either front or side. A strong, well-curved beak, and large, medium- to coarse-textured comb. Smooth, clean face and bright challenging eye. And still she does not lay eggs in the nest but does ovulate inside the body where the yolks are absorbed. The bird in reality is feeding herself from the inside on egg yolks. This is a common occurrence. Such a bird is likely to be overlooked when culling because she has all of the external appearances of heavy production. This is exactly what should be expected since the hen although ovulating is not removing the egg product from her body. However, assimilation of egg substance in some instances produces injurious results, due to the accumulation of unabsorbed yolks, in which event the bird ceases production and takes on the usual characteristics common to a bird not laying or shows the effects of the accumulated yolk material by a debilitated condition.

The term describing Foreman's (5th) head type, "lacking in character," is objectionable because it is a phrase and not a single word, and since the type of bird which is included in this class is "phlegmatic" this term has been adopted. (Fig. 71.)

The word "*incomplete*" (hermaphroditic), Foreman's (6th) term, though correct in description is not as accurately expressive as the word "*masculine*," which exactly describes in appearance the characteristics which the unsexed hen takes on. (Fig. 72.)

In addition to Foreman's six grades it has been found necessary to provide a new grade and a term and to describe it. The new grade includes a quality of production, a latent reserve power and capacity to "carry on" for many years which is not comprehended in the word *refined*, Foreman's highest grade. Hence the term "*rugged refined*" was suggested by the senior author at the Cornell Poultry Judging School in 1925. The prefix *rugged* suggests large capacity and longevity values, and *refined* suggests nervous temperament and the quick response of an exceptionally high producer. (Figs. 74, 75, 76 and 77.)

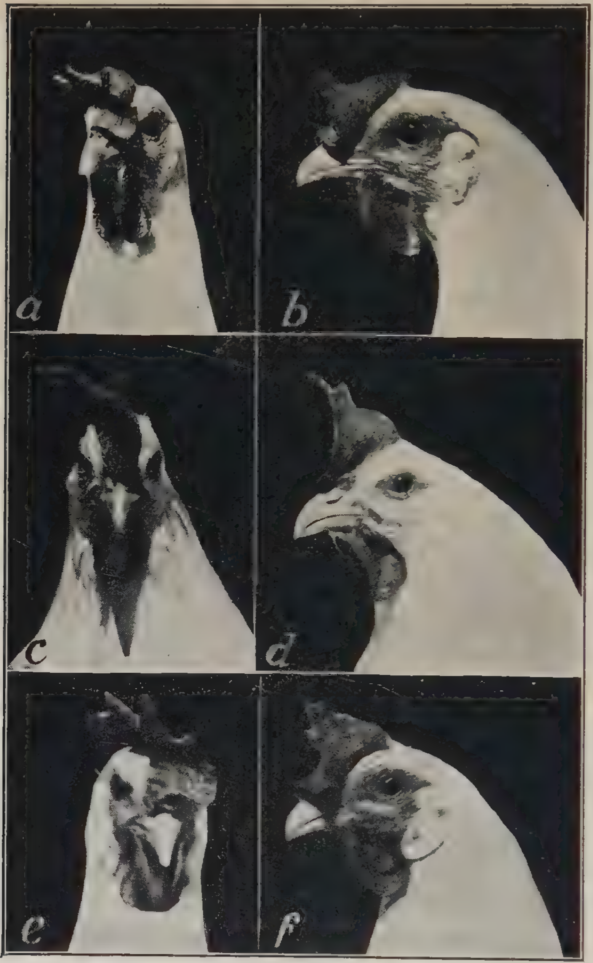


FIG. 74.—Refined and Physically Strong but not Highly Prolific.
a–b laid 186, *c–d* 186 and *e–f* 198 eggs. All three hens have excellent head balance.

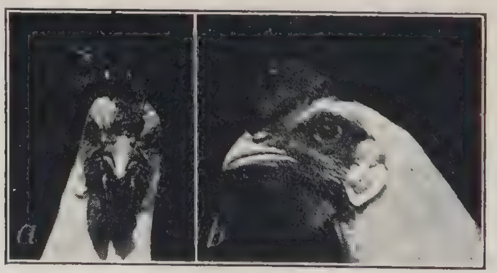


FIG. 75.—A Rugged-refined Head—More Rugged than Refined.
Note the strong beak and broad, flat head. She laid 277 her first year.

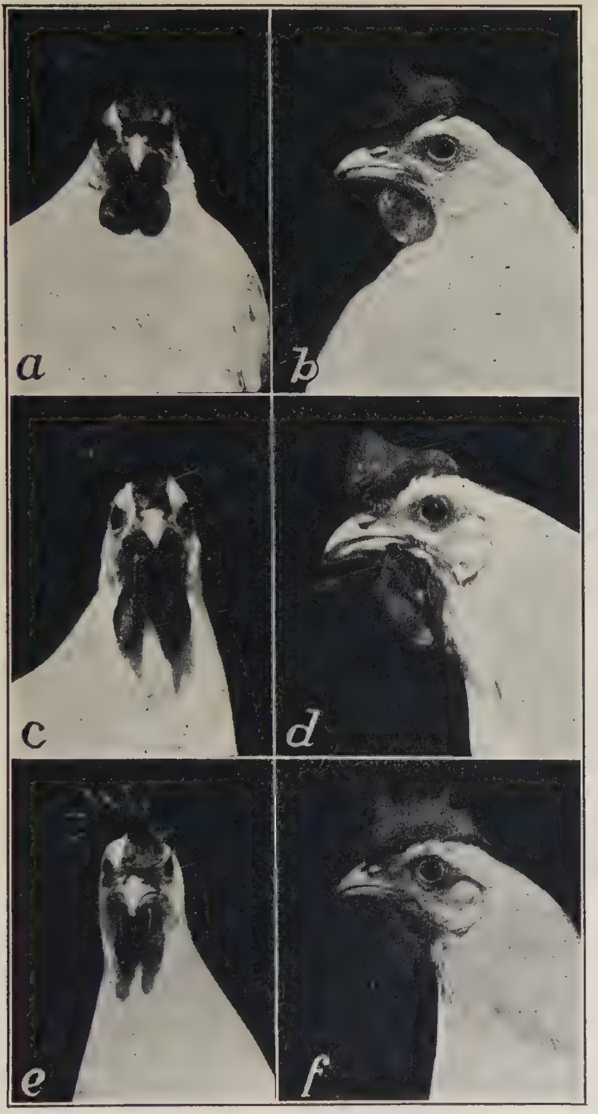
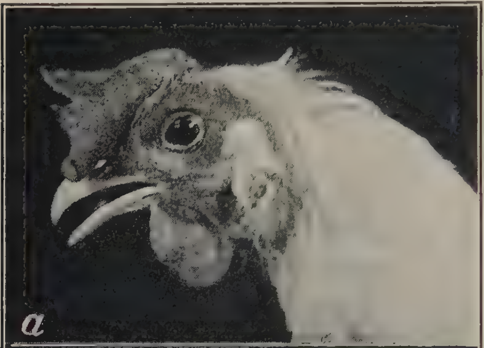
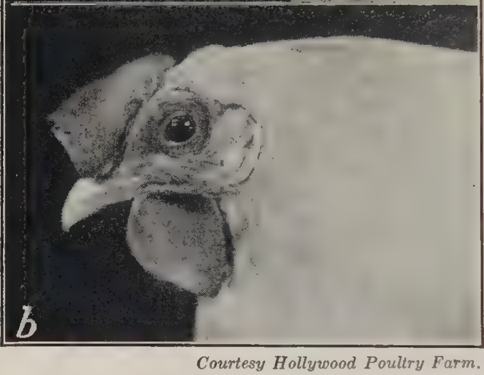


FIG. 76.—Front and Side Views of Three Heads Which Approach the Rugged-refined Type.

They laid *a–b* to *e–f*, 241, 255 and 239 eggs, respectively. *a–b* is more refined and less rugged than the other two. *e–f* is the most rugged but is not perfect. *c–d* has good head balance but should be more rugged to make a long-distance 300-egg bird.

No doubt the reason why the term *rugged refined* was not suggested earlier was the fact that at first there was not the need for the *rugged refined* class. Not so many years ago the word *refined* appropriately represented our highest grade in production, about 200 to 250 eggs. But with the more recent advance in breeding for high production and for larger eggs has come the necessity for breeding larger, longer-lived birds to stand up under the larger and larger demands. The greater number of hens judged each year in the 250 to 300 egg or higher classes, and the number of such birds found on breeding farms, furnish the proof of the justification of the *rugged refined* class.





Courtesy Hollywood Poultry Farm.

FIG. 77*a*.—A Rugged-refined Head.

Note the reserve power; prominent, expressive eye; strong beak; clean face; bald head; and waxy comb.

This is the head of Hen 1189, Michigan Contest, Nov. 1, 1927 to Oct. 31, 1928. Laid 300 eggs and had a score of 295.4 points.

Courtesy Hollywood Poultry Farm.

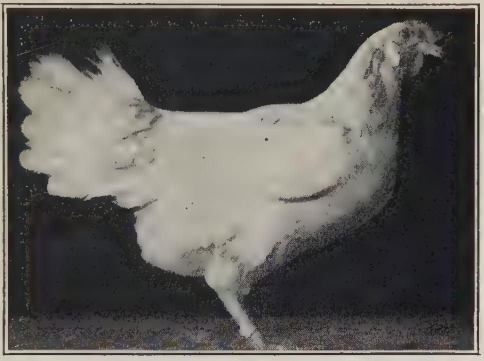
FIG. 77*b*.—A Distinctly Effeminate, Refined Head.

New feathers on head indicate relaxed production activity. Waxy, medium to large comb.

Head of 376, West Washington Contest. Record—325 eggs, Nov. 1, 1927 to Oct. 31, 1928. Best hen in Contest. Sire was "Red 16."

The *rugged refined* head and body associated with high production were found among many birds and hence this quality had to be described and named. It may not be too prophetic to predict that the superior quality and increasing number of "*rugged refined*" birds may soon justify dividing this group into two grades. In this event some suitable term must be found to describe adequately the finest triumphs of production breeding. *Super-rugged refined* might express the quality. (Figs. 78 and 79.)

APPROXIMATE ESTIMATED PRODUCTION TO BE ATTRIBUTED TO EACH OF THE PROPOSED SEVEN HEAD TYPES



Courtesy J. A. Hanson.

FIG. 78.—"Super" Rugged-refined Head and Heavy, Parallelogram-shaped Body.

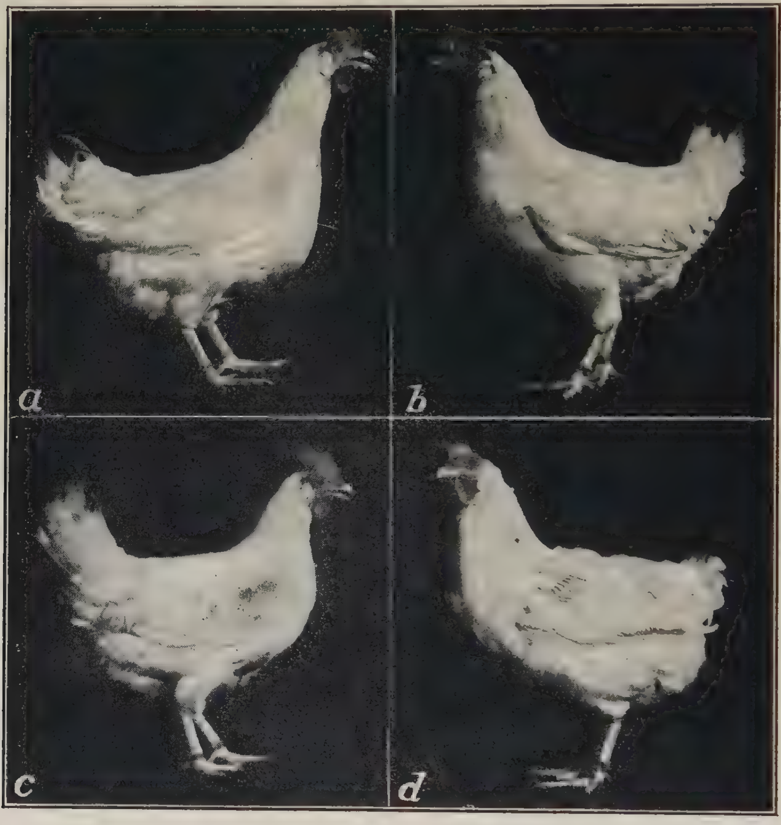
She laid 337 eggs in one year, 312 of which were standard in size. Is there an egg type? What should be the standard description of a high producing, long-lived hen? To answer this question for the Leghorn look at the masterpieces in Figs. 79 and 87.

Although it is not possible with our present limited knowledge to estimate accurately the past or future production of birds within narrow limits or even into high and low individuals in all instances, nevertheless modern knowledge and skill do enable a properly qualified person to designate certain ranges of expected production, with the understanding that there will be overlapping above or below the predicted production for any particular head type. The following statement of the expected production of birds, under normal conditions of management, classified according to seven head types, will serve as an approximate general guide in undertaking to estimate their production.

Head Type	Approximate Estimated Production, Number of Eggs
1. Refined.	
a Rugged refined	250 to 300
b Refined	200 to 250
c Overly refined	150 to 200
2. Unrefined.	
d Crow-headed	100 to 200
e Coarse	50 to 150
f Phlegmatic	25 to 100
g Masculine	0 to 50

The seven types naturally may be grouped into two classes: (1) those that are *Refined* and (2) those that are *Unrefined*. The former include types *a*, *b* and *c*, laying 150 eggs or more, and the latter types, *d*, *e*, *f* and *g*, laying less than 200 eggs. The refined group *a*, *b* and *c* may be termed good layers, and those in *d*, *e*, *f* and *g*, medium to poor layers.

Suitable to the needs of most persons who would desire to specify three groups of birds according to their production qualities the breeders would be found in types *a* and *b*, the commercial layers in types *c*, *d* and *e*, and the culls for market types *f* and *g*. When thus segregated according to head types into the above three groups, reasonably accurate selection should be made.



Courtesy Iowa State College of Agriculture.

Fig. 79.—Four White Leghorns with Rugged-refined Heads and Bodies to Match. *c* is Slightly More Refined than *a*, *b* and *d*.

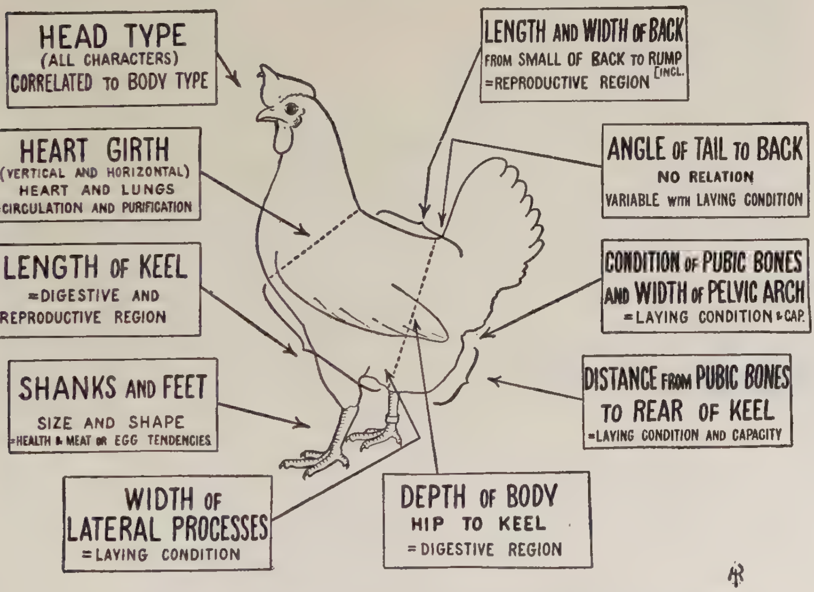
a laid 300 eggs the first year and 221 the second year. Weight, 4.8 lb.
b laid 304 eggs the first year and 196 the second year. Weight, 4.4 lb.
c laid 304 eggs the first year and 222 the second year. Weight, 3.9 lb.
d laid 309 eggs the first year and 235 the second year. Weight, 4.2 lb.

In actual practice on the farm it is assumed, of course, as it would be in the showroom, that the head character would not be used alone, but would furnish invaluable information to check with body type, molt, pigment, etc. This contribution alone is a great accomplishment.

CHAPTER VIII

BODY TYPE, INTERNAL ANATOMY, AND CHANGES IN PHYSICAL CONDITION AS AFFECTING EGG PRODUCTION

Body type is the outline of a bird when seen from any direction. The outline is determined by the skeleton or bony framework and muscular development. The plumage is merely the covering of the bird which materially modifies the appearance but cannot be considered as determining the type. The plumage together with the bony framework and muscular tissues form the outline which in the judging of live birds is used to express type as a characteristic of breeds of poultry. Body type is a character which can be used with both sexes of mature birds, at any time of year, and even in immature or young birds.


HEAD TYPE
(ALL CHARACTERS)
CORRELATED TO BODY TYPE
LENGTH AND WIDTH OF BACK
FROM SMALL OF BACK TO RUMP (INCL.
=REPRODUCTIVE REGION
HEART GIRTH
(VERTICAL AND HORIZONTAL)
HEART AND LUNGS
=CIRCULATION AND PURIFICATION
ANGLE OF TAIL TO BACK
NO RELATION
VARIABLE WITH LAYING CONDITION
LENGTH OF KEEL
=DIGESTIVE AND
REPRODUCTIVE REGION
CONDITION OF PUBIC BONES
AND WIDTH OF PELVIC ARCH
=LAYING CONDITION & CAP.
SHANKS AND FEET
SIZE AND SHAPE
=HEALTH & MEAT OR EGG TENDENCIES
DISTANCE FROM PUBIC BONES
TO REAR OF KEEL
=LAYING CONDITION AND CAPACITY
WIDTH OF LATERAL PROCESSES
=LAYING CONDITION
DEPTH OF BODY
HIP TO KEEL
=DIGESTIVE REGION

Courtesy Poultry Department, Cornell University.

Fig. 80.—Body Measurements Used in Determining Egg Production Type.

The various body type characters relating to egg production are spoken of as anatomical or permanent characters, as contrasted with physiological characters such as pigment or molt changes. The various external body measurements which have been studied in relation to egg production are illustrated in Fig. 80, reproduced from a drawing of a live bird. Fig. 81 shows the same measurements on the skeleton of a bird.

In general the body type may be used as an indication of *laying capacity, laying condition, constitutional vigor* and *sex dominance*. There are several body measurements or sections of the body which may be discussed separately and the relation each has to body functions and to egg production pointed out.

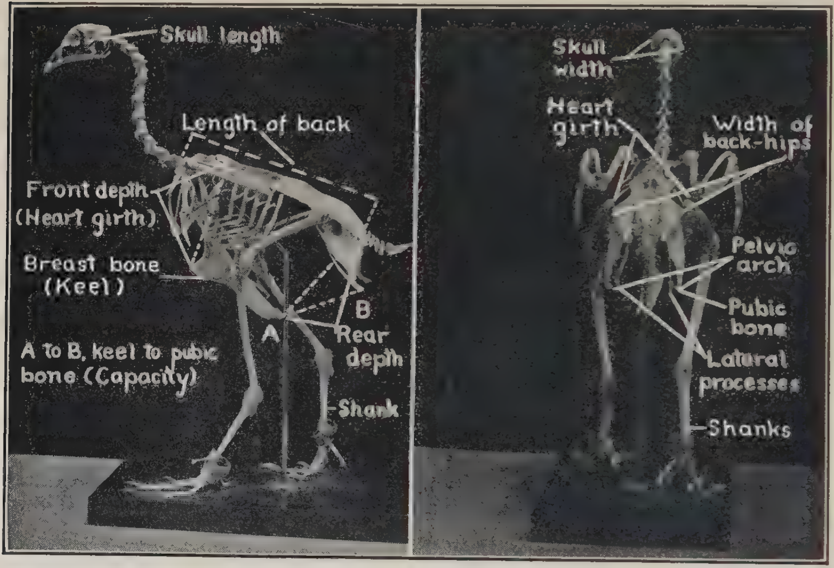

Skull length
Length of back
Front depth
(Heart girth)
Breast bone
(Keel)
A to B, keel to pubic bone (Capacity)
A
B
Rear depth
Shank
Skull width
Heart girth
Width of back-hips
Pelvic arch
Pubic bone
Lateral processes
Shanks

Fig. 81.—Skeleton Showing Measurements Used in Body Type. Side View and Rear View.

BODY TYPE

Head Type.—This section of the bird is very closely correlated with all other parts of the body. This makes it a key character. Hence, all of Chapter VII is devoted to a discussion of the relation of head type to egg production.

Head type is perhaps the most important single section of the body which can be used in judging poultry for egg production.

Heart Girth.—The second section of the body is that of the heart

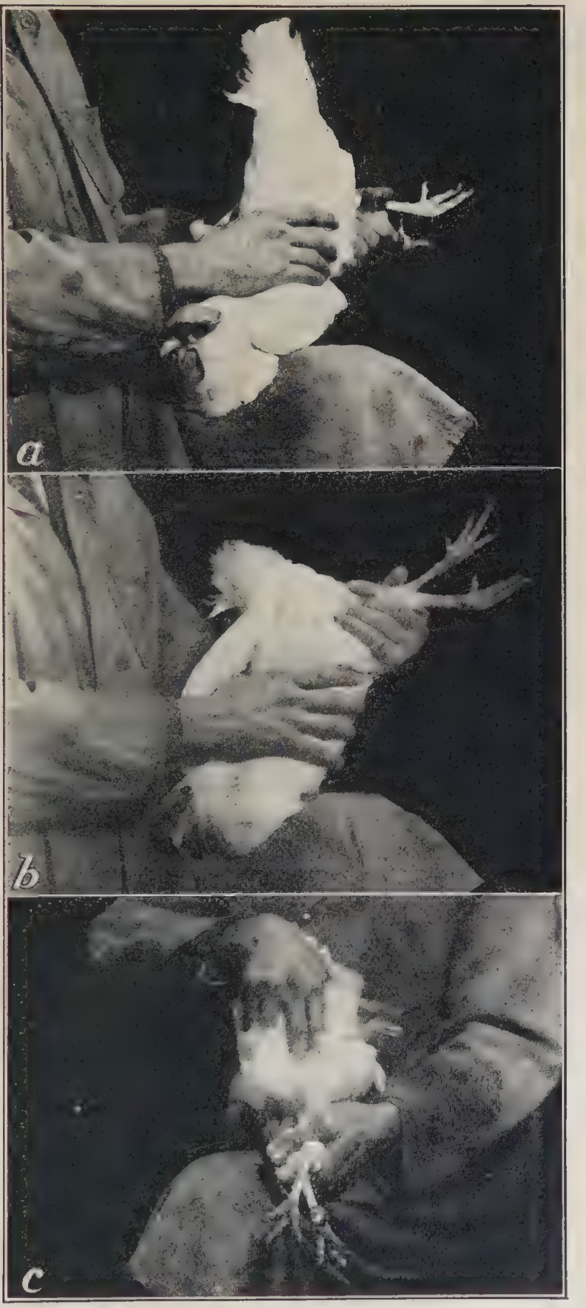


FIG. 82.

(a) Method of measuring heart girth and width of back.
(b) Method of measuring depth of body.
(c) Method of measuring width of pelvic arch.

girth, or spring of ribs and depth of the anterior (front) portion of the body. The spring of the ribs may be measured by the use of the thumb and fingers, by resting the palm of the hand on the back just behind the shoulders with the thumb and fingers along the sides of the bird as shown in Fig. 82*a*. By sliding the hand along the back, the width of the loin, the hips and the pelvic region (rump) can be determined. The depth is measured by placing the thumb on the small of the back of the bird, about midway between the hips and the wings, directly above the middle of the keel bone, with the fingers at the front end of the keel. (Fig. 82*b*.) By sliding the thumb along the back and at the same time the fingers along the keel, the relation between back and keel, for the entire length of the bird, can be determined readily. Heart girth and front depth indicate a bird's capacity in this region of the body. This section is comparable to the human chest measure.

Within this section of the body are found some of the most vital organs of the internal anatomy of the fowl, namely, the heart and lungs. These organs are essential first for life itself, and further they must be of sufficient size to enable them to take care of the extra work imposed upon them by high egg production. These organs, together with the liver and kidneys, are responsible for the circulation and purification of the blood, and of the carrying of food nutrients and of body fluids to various parts of the body, and the elimination of waste materials. Good capacity, then, in this region is absolutely essential and hence we cannot expect high or efficient production in narrow-chested, shallow-bodied, or small birds.

Length and Width of Back.—This region of the bird is located at a point beginning where the last ribs join the backbone and extends to the posterior (rear) end of the body. The length of back generally includes the section of the bird described under heart girth as well as the rear portion of the back. The width of this section of the bird may be determined by continuing to move the hand backward when in the same position as shown for measuring the spring of ribs (Fig. 82*a*) throughout the entire length of the back. The back should be wide and carry its width throughout. This is one of the most important sections of the body as indicating constitutional vigor and longevity. The reproductive organs, the ovary and oviduct are located there. Moreover, a strong back is the first essential to a rugged constitution. It is here that the process of egg formation is carried on; hence the necessity for good capacity. If a hen is to lay many eggs weighing two ounces each (twenty-four ounces to the dozen) she must have *actual* capacity in this region great enough to hold the egg after it has been completely formed and to lay it without injury or discomfort. Birds with narrow backs, or backs which are pinched at the rear, or birds small in size, will lack cubic capacity for satisfactory egg production.

Angle of Tail to Back.—This character apparently has no relation with egg production; it varies greatly with different breeds and varieties of birds as well as with different strains of the same variety, and usually between individuals of the same strain, except as the angle of the tail is influenced by changes in body weight and type due to production. (Fig. 80.)

Condition of Pubic Bones and Width of Pelvic Arch.—Pubic bones which are extremely stiff or are very blunt and thick, due to heavy layers of fat, indicate that the bird is in a dormant condition, or is not drawing on the body fat at a very rapid rate for egg production. The bird which has been laying heavily for a few weeks will almost always have pubic bones that are of medium thickness and are flexible rather than stiff. Extreme thinness and flexibility of these bones are undesirable because such conditions often indicate some constitutional weakness.

The width of the pelvic arch, or distance between the pubic bones, may be taken as an indication of laying condition and capacity. This measurement changes very materially as a bird passes from a laying to a dormant condition, or vice versa, the width being narrow in dormant birds and wide in birds laying heavily. This was one of the characters used by Walter Hogan in what is known as the " Hogan System " for the determination of egg production quality. (Chapter II.) It was one of the first external characters used in attempting to determine egg production. Since it is a measurement which changes from time to time it cannot be used in the same manner as the more fixed characters, such as width of back. If a group of birds are taken when they are all laying heavily and the width of the pelvic arch is determined for each bird there will be little if any relation found to exist between this measurement and the number of eggs each hen will lay in a year. The width of the pelvic arch may, however, be used with a fair degree of accuracy at certain times of the year, in telling the laying condition of birds; that is, whether the bird is laying or dormant, and in this way be a great aid in picking out the best layers in a flock of birds, for example, pullets laying their first eggs as indicating precocity or laying their last eggs as indicating persistency. Fig. 82*c* shows the method of measuring the width of the pelvic arch.

Care must be taken in using this measurement since the width between the pubic bones may be caused by an accumulation of hard fat, rather than the actual distance between the bones. Such a condition is often found in birds with meat-producing tendencies.

Distance from Pubic Bones to Posterior (Rear) End of Keel.—This character indicates laying condition and capacity, and may be determined by placing the fingers on the rear end of the keel and the ends of the pubic bones. (Fig. 83.) A measurement similar to this one which is called rear depth, is obtained by placing the thumb on the back of the bird, just behind the hips, and the fingers on the rear end of the keel. This measurement is very similar to the width of the pelvic arch in its relation to egg production as it changes with laying condition. Large capacity is desired, as a hen must consume large quantities of food in order to lay well and the digestive organs which transform the food nutrients into material for the production of eggs or meat, and body maintenance, are located in this region. The distance between the pubic bones and the rear end of the keel is influenced also by the length of the keel bone itself. A short keel bone would increase the distance from the pubic bones without any increase in depth of abdomen to indicate larger body capacity and therefore would be a deceptive measurement. (Fig. 84*a*.) This measurement, if the length of the keel is normal, would indicate the abdominal capacity.

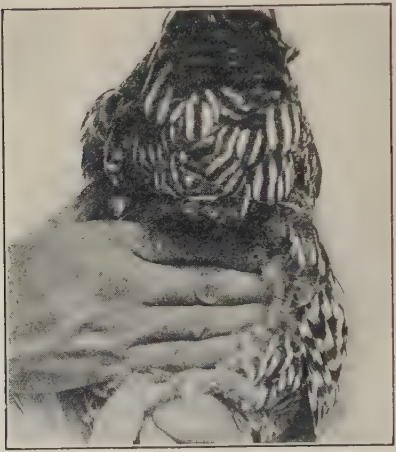


Fig. 83.—Method of Measuring Distance from the Pubic Bones to the Rear End of the Keel Bone.

The Length of the Keel or Breast Bone.—The keel is the floorboard upon which the internal organs of the bird rest. It should have plenty of length rather than be too short. This is because birds with short keels are very likely to break down in the abdomen under very heavy production or when very fat, this being especially true of the general purpose or heavy varieties. (Fig. 84*a*.) A slightly rocker-shaped keel is desired because stronger to resist pressure from above. (Fig. 84*b*.)

Lateral Processes.—The distance between the lateral processes may be used to indicate capacity and laying condition, as well as the physical condition of the bird. This measurement is relatively hard to obtain satisfactorily. The pubic bones indicate the same conditions relative to egg production as the lateral processes.

Shanks and Feet.—The condition of the shanks and feet may be taken as an indication of health and of meat or egg production tendencies. A round, fleshy, coarse-scaled shank is indicative of a meat-

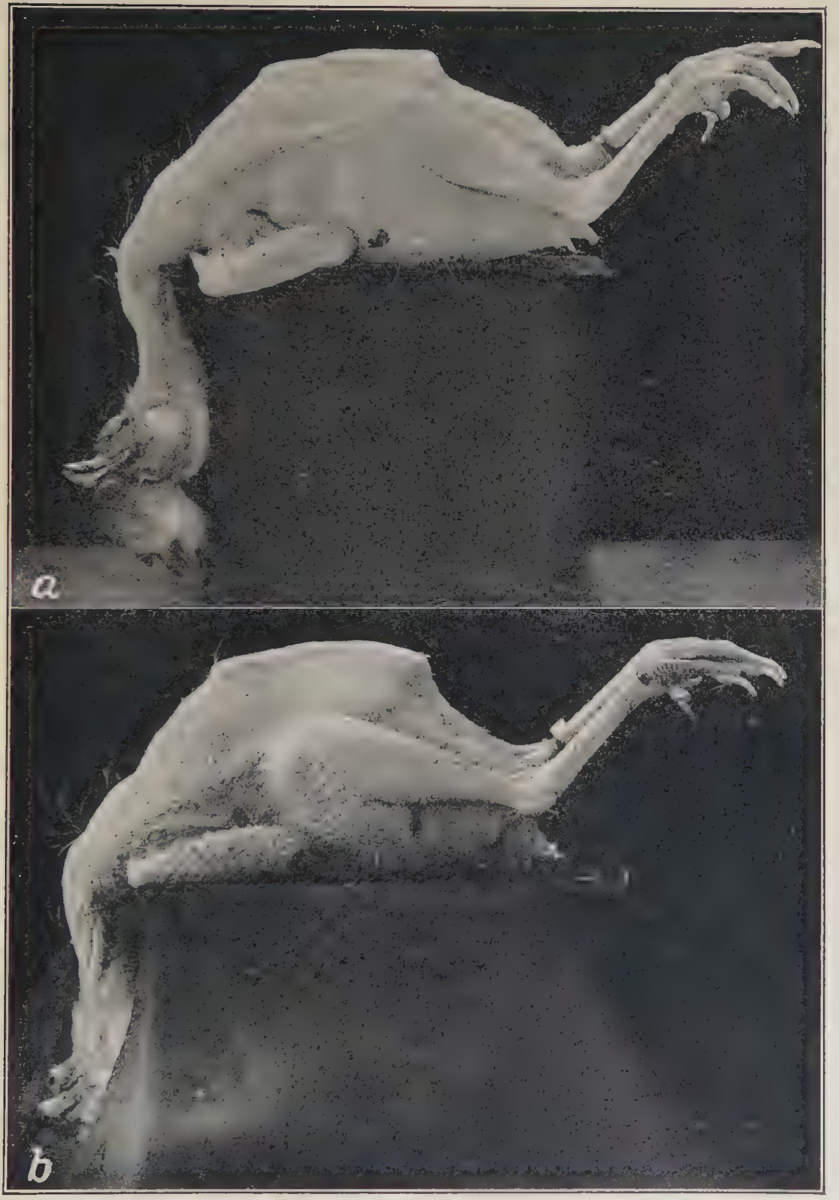


FIG. 84.—The Length of Keel Is an Important Measurement.

a. A bird with a short, straight keel.
b. A bird with a long, slightly rocker-shaped keel.

production tendency whereas a shank that is somewhat triangular in shape and one that does not have a fleshy appearance is associated with an egg type bird. There is great variation between different breeds and varieties with respect to this character.

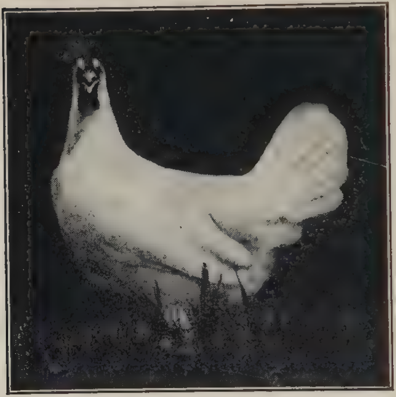


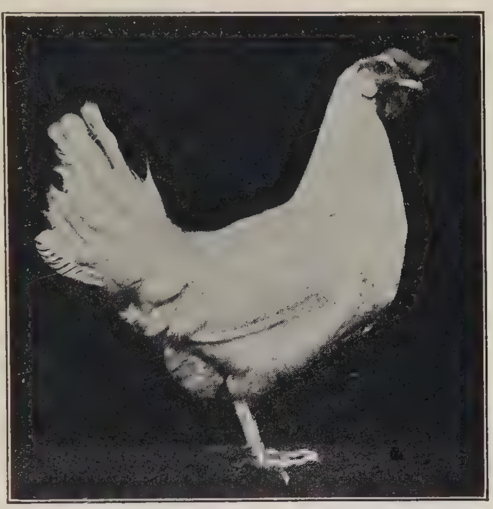
Fig. 85.—A Bird of Ideal Egg Type.

Combining all of these characters together into one individual would produce a body type which would approximate a rectangle in shape as viewed from one side, slightly longer on the back than the keel and slightly deeper in the rear than in front in the case of the female which is laying heavily, and a body that blends well in all its parts. (Fig. 85.) Such a bird might be called an "ideal egg type," but since it is entirely possible to have such a body in the smallest and the largest birds and with all grades between, and any of them lay a large number of eggs, as far as numbers are concerned, we must limit the term "ideal egg type" to a bird which will lay efficiently and define what is meant by "efficient egg production."

EFFICIENT EGG PRODUCTION

"Efficient egg production" means a great deal more than simply the number of eggs laid in one year. The smallest breed might be so bred that under proper feed and management conditions a hen would lay as many small eggs in a year as a larger bird, but it would be unprofitable to produce or sell such eggs commercially. An efficient egg producer, then, might be described as a hen that would lay two hundred or more eggs in one year, all of which would be of desired shape and color and weigh two ounces each or more, or 24 to 28 ounces per dozen. Although theoretically there is a definite type of bird for most efficient egg production the exact size and type has not been demonstrated and agreed upon. Such a bird, according to the general opinion of breeders, will be found in a Single Comb White Leghorn, of standard weight, 4 to 5 pounds. (Figs. 86 and 87.) The general purpose varieties, used for egg production and meat production combined, should weigh from $5\frac{1}{2}$ to 7 pounds, with a body somewhat similar in outline to the one described above. The males in the case of Leghorns should weigh one pound more than the females and the General Purpose varieties two pounds more.

High egg production, however, may be obtained in a large number of varying body types. This is apparent by the fact that medium egg production is obtained from many different breeds and varieties of chickens, and if the numerous varieties are considered from the standpoint of body type very great variations will be found. If the very best producing Plymouth Rocks, Rhode Island Reds, Leghorns, Wyandottes, and even such a heavy breed as the Brahma, are considered in a class it will be found that they have a similarity of type, as regards body conformation, and balance. In other words, high egg production tends to eliminate breed differences and produce a type best fitted to efficient egg production. (Fig. 88.)

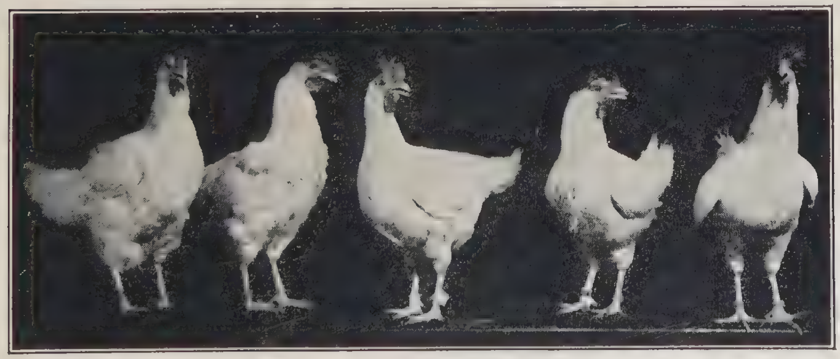


Courtesy J. A. Hanson. Corvallis, Oreg.

FIG. 86.—A Rugged-refined Individual with Ample Capacity for Efficient Production.

Hen 1206, laid 340 eggs (1929). It is especially meritorious that she laid large eggs during her pullet year as well as her second year, 25 to 30 ounces per dozen.

Since a 4- to 5-pound Leghorn or a 5½- to 7-pound Plymouth Rock,



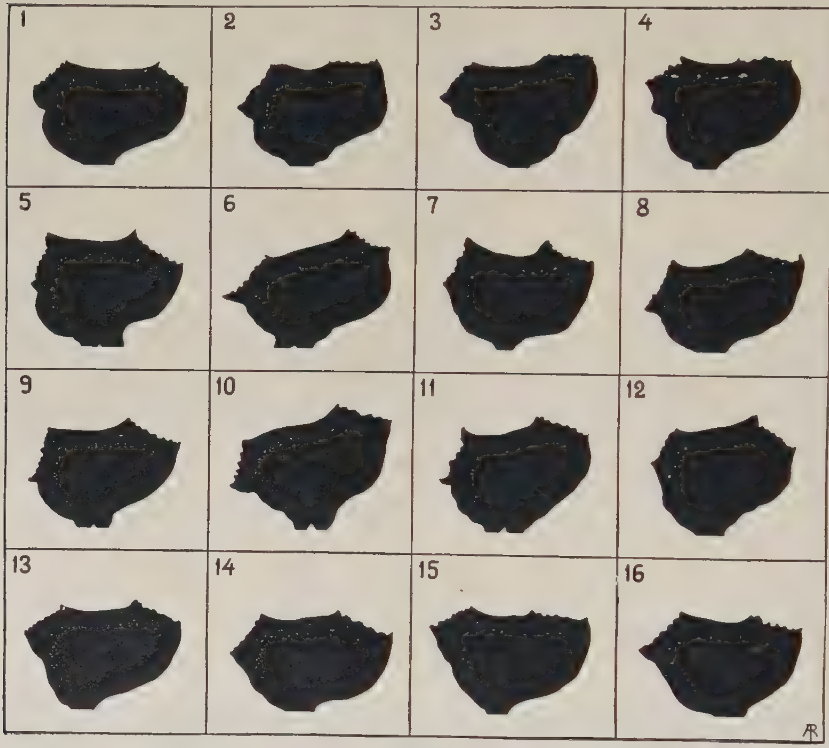
Courtesy Iowa State College of Agriculture

FIG. 87.—Built for the Job.

These hens are "rugged-refined" in all sections, head, body and shanks. From left to right they laid 305, 309, 304, 304, and 300 eggs each their first year or a total of 1522 eggs.

Rhode Island Red or Wyandotte has been found large enough for efficient egg production there seems to be no necessity to produce a larger or smaller bird for commercial egg production.

The bird first must maintain her body if she is to produce eggs efficiently and remain well, but there seems no justification in maintaining more weight than is necessary to accomplish the objects named. The excess weight must be maintained at a loss so far as egg production is concerned. Therefore, it is apparent that one need not pay much attention to relative weights and measurements as between different birds when judging because a 6-pound hen must necessarily have a wider back than a 3-pound hen if both are normal individuals. The important relationship to consider is the balance between different



Courtesy Poultry Department, Cornell University.

FIG. 88.—High Producing Hens of Different Breeds Have Similar Body Types.

Hens 1 to 16 laid nearly 300 or more eggs each in one year.

The key to the 16 body types shows the following records: (1) Ancona, 331 eggs; (2) Black Orphington, 339 eggs; (3) Barred Plymouth Rock, 111 in one cycle; (4) White Wyandotte, 303 eggs; (5) White Rock, 281 eggs; (6) Leghorn, 297 eggs; (7) Leghorn, 1243 eggs in 7 years; (8) Leghorn, 330 eggs; (9) Leghorn, 330 eggs; (10) Leghorn, 326 eggs; (11) Leghorn, 307 eggs; (12) R. I. Red, 261 eggs; (13) Leghorn, 300 eggs; (14) Leghorn, 304 eggs; (15) Leghorn, 295 eggs; (16) Leghorn, 316 eggs.

TABLE 10

Relations between External Body Measurements of Fowls and Annual Egg Production

Annual Production Relative to:	Asmundson (1920), 280 S. C. White Leghorns	Hall (1923), 100 S. C. White Leghorns	Sherwood (1922), 128 S. C. White Leghorns	Waters (1927), 200 S. C. White Leghorns	Moore (1927), 144 S. C. White Leghorns	Scholten (1927), 727 Leghorns[1]	Scholten (1927), 287 Barnevelds[1]
Weight of bird	0.23±0.04	−0.21±0.06	0.01±0.06	−0.02±0.05	0.28		
Length of keel	0.03±0.04	0.15±0.07	0.21±0.06	−0.07±0.05	0.23		
Length of back		−0.16±0.07		−0.03±0.05	0.11		
Front depth	0.25±0.04	−0.03±0.07		−0.03±0.05	0.28		
Rear depth	0.37±0.03	−0.06±0.07	0.17±0.06		0.11		
Width of hips	0.36±0.04	0.03±0.07			0.19	0.14±0.05	0.30±0.05
Width of shoulders		−0.17±0.07			0.21		
Width of Rump		0.09±0.07			0.08		
Distance between pubic bones	0.35±0.04	−0.15±0.07	0.21±0.06		0.21	0.30±0.03	0.39±0.05
Capacity of abdomen	0.23±0.04	−0.14±0.07	0.09±0.06			0.29±0.03	0.29±0.05
Length of shank		−0.19±0.07			−0.18		
Oil gland to front of keel (diagonal)		−0.15±0.07			0.32		
Base of neck to rear of keel (diagonal)		−0.04±0.07			0.18		
Length of keel ÷ weight	0.33±0.04		0.15±0.06	−0.04±0.05			
Front depth ÷ weight				0.02±0.05			
Rear depth ÷ weight			0.15±0.06				
Width of cranium				−0.19±0.05			
Depth of head				0.10±0.05			

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[1] All measurements relative to length of back.

sections of the same individual. The highest layers are those that approach perfect production balance. Such a balance exists when each part of an individual is properly developed and coordinated in such a way as to provide a proper working relationship with every other part in order that all may function with the greatest efficiency. Both hens and males must be selected for actual weights and measurements, to conform to a certain body type and balance, up to a certain weight beyond which it would not be economical to go. In other words, a bird might possess an ideal body type for egg production but be so small that it would not be large enough to produce efficiently, or so large that it could not produce economically.

STATISTICAL MEASUREMENTS

Several investigators have made external body measurements and observations on large numbers of birds, and worked out mathematical relationships between these measurements and egg production. The results of these investigators have not been in very close agreement, and the work has not shown relationships as significant as were thought by many to exist, where representative samples of the poultry populations studied have been taken. The results of the studies of several investigators are given in Table 10, expressed in the form of coefficients of correlation, which indicate the manner in which two variables vary with respect to each other. Since annual production is the best measure of a bird's ability to produce eggs, all correlations given in the table apply to the relation between annual production and the body character cited in the table.

Work done by Hall (1926) showed a correlation of -0.18 ± 0.10 between weight of bird and annual production in the case of 55 birds in dormant condition and -0.15 ± 0.07 in the case of 81 birds in laying condition.

Results.—By a very careful study of the results of these investigators in their efforts to present statistically the relation between annual egg production and body measurements some very interesting points are illustrated. Of seven different groups of birds studied, five showed no significant relation between weight of bird and annual egg production. The correlations obtained by the other two investigators, though significant, are low in value. It is also interesting to note that the two investigators who found positive correlations between body weight and annual egg production, also found, in most cases, positive correlations between the individual body measurements and annual egg production. On the other hand the investigators who found no correlation, or a slight negative correlation with annual egg production, also found little or no relation between the individual body measurements and egg production.

In case of the three groups of birds studied by Hall, all birds at the time the observations were made were either in heavy laying condition or dormant; two groups in laying and one dormant were studied. The correlations for these three groups of birds between annual egg production and weight of bird were negative and agreed very closely. In all other cases the groups of birds studied were mixed birds, in all stages of laying or dormant condition. Therefore it may safely be assumed that where a mixed group of birds is used the relationships obtained simply reflect laying condition at the time the observations were made, and not the true relationship between annual production and body measurements, since certain body measurements vary materially in the same bird under different conditions of production and dormancy.

Scholten (1927) reports on body measurements in relation to egg production on 1024 birds, 727 Leghorns and 297 Barnevelds. Only relative measurements were used in this study, the length of back being taken as the constant. The relative values for the different measurements were obtained by the formula of Durst,

$$Y = \frac{a \times 100}{c},$$

in which a and c represent the two measurements which are compared, a being expressed in percentage of c, so that c is always the back length. This work led Scholten to conclude as follows:

> "There exists a positive correlation between various external measurements of the hen and her egg production. This correlation is so slight, however, that it is of no value in selecting the most productive birds according to external characters; and in both light and medium heavy birds it is too small to be of any practical value."

It is a common observation by poultrymen that the highest producers usually are not the largest birds in a flock or strain. This would have to be the condition if a very pronounced, significant, positive correlation were to exist between body weight or body measurements and annual egg production. On the other hand the tendency is for the size of the body to decrease with continued selection for numbers of eggs without regard to size of eggs or size of bird. Since there is a close relationship between body weight and single body measurements, it would be expected that any body measurement taken alone would tend to have the same relationship with annual production as body weight itself, and by referring to the results given in the table it will be found that this is what actually occurs.

In order then, to determine the true relationship between body measurements and annual egg production, birds must be in the same laying condition. The results of investigations which have been made until the present time have not shown any significant relation to exist between body measurements and *numbers* of eggs laid, if the birds are all in the same laying condition. However, this does not prove or indicate that there is not a most efficient type for egg production.

This can be readily understood if one stops to analyze the problem. Both body type and the ability to produce eggs are inherited, and they are not necessarily inherited together any more than white plumage color is combined or even associated with high or low egg production. They are two entirely separate and distinct factors. Therefore, a bird may inherit a superior body type; that is, have a wide back, good heart girth and plenty of capacity, and not be a satisfactory egg producer. However, it is found that most high producers do have bodies well suited to the job because a good body is necessary in order that the inherited factors responsible for high egg production may express themselves. Nevertheless among the poor producers will be found birds with excellent bodies, and it is these birds that may be mistaken for good producers if body measurements are used in judging without the aid of physiological characters such as pigment and molt changes and changes in physical condition, actions, etc., which have a very close relation to egg production as illustrated in Chapters IV, V and VI.

Although actual or relative body measurements may not show a significant relation to numbers of eggs, nevertheless, if a flock of birds is considered as a whole, the size of the body does have a distinct relation to size of egg, the larger birds in a particular strain laying the larger eggs; and for this reason alone birds should be selected which are large enough to lay desirable sized eggs. Fig. 89 shows the change in body size of two groups of birds over a long period of time. Compare these changes with changes in egg weight during the same period. (Fig. 132.)

In summing up the results of investigational work on the subject of body type and body measurements it would seem logical to conclude that there is a definite body type associated with efficient egg production, although due to the lack of the inherited factors for high egg production there are many birds of good egg type which do not produce well. They inherited the factory but without some of the essential machinery installed. They lacked the power plant, so to speak, for driving the egg machinery. They lacked the urge to lay. Hence the well-built factory could not produce. It follows therefore, that in selecting birds for egg production, they should first have a good body, the factory, but should have associated with this character the physiological characters indicative of production values. These characters reflect the presence or absence of the inherited tendency to lay.

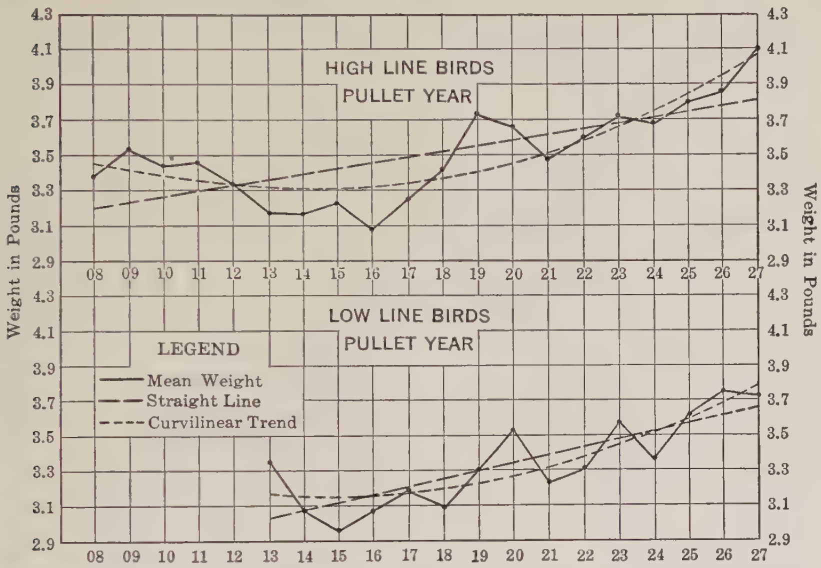
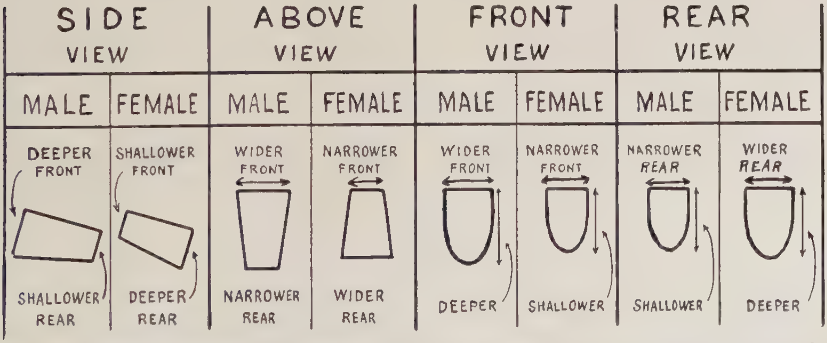


Fig. 89.—Changes in Body Weight in High and Low Line Birds over a Period of Several Years.

The straight line trend was distinctly upward in case of both lines.


SIDE VIEW
ABOVE VIEW
FRONT VIEW
REAR VIEW
MALE
FEMALE
MALE
FEMALE
MALE
FEMALE
MALE
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DEEPER FRONT
SHALLOWER REAR
SHALLOWER FRONT
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WIDER REAR
WIDER FRONT
DEEPER
NARROWER FRONT
SHALLOWER
NARROWER REAR
SHALLOWER
WIDER REAR
DEEPER

Fig. 90.—Diagrams Showing Differences in Body Type of a Normal Male and Female.

It is necessary to maintain proper balance of sex dominance, i.e., masculine males and effeminate females in order to avoid producing hen-bodied males and male-bodied hens.

Except for sex differences, body type in production males differs in only a few important respects from those of the female. Generally males are deeper in front body measurements than females, and are more shallow at the rear of the body. There are no outstanding changes in body measurements in males comparable to changes in distance between the pubic bones and distance from keel to pubic bones in the female, depending upon laying condition. The main differences in body type between males and females are illustrated in Fig. 90.

INTERNAL ANATOMY

The relation of internal anatomy to egg producing ability can have only an indirect bearing upon the selection of birds for egg production, as it is impossible to determine accurately and then only by correlation with external characters, the size and type of the internal organs and still retain the individual birds for production. This is because we cannot know exactly what the inside of a bird looks like without killing it. It is important, however, to know if a positive relation does exist between various internal organs and egg production. There is no doubt but that a close relation does exist between certain internal and external characters. Very little fundamental research work, however, has been done on this subject.

Some studies, however, made by Hall, of Cornell University, throw some light upon this important region of the bird. Two lots of birds were examined, both groups being of similar type and breeding. The first group of 55 birds were all in dormant condition when the observations were made, while the second group of 81 birds were all laying. In order to be sure that all birds were in laying condition, the birds were trap-nested. Each bird was allowed to come into laying and lay several eggs. At the time each bird was killed, she was taken from the trapnest with an egg in the oviduct, or was killed within 12 hours of the time she had laid an egg in the trapnest.

The relationships found to exist between the weights and measurements of the internal organs and annual production are very similar to those found by the many investigators working on external measurements; that is, that very little correlation was found to exist between the internal organs and annual production. This lack of a positive relationship between these characters is to be expected since we do not find that egg production increases proportionately as size of bird increases. Size of body and size of internal organs are definitely correlated.

This study on internal anatomy does, however, bring out some interesting facts. The relations of the internal organs to egg production for the two groups of birds were in very close agreement. It was found that birds when out of production or in a dormant condition weigh less than when they are ready to begin laying or are in a laying condition. The average weight of the dormant group was 1593 grams (3.51 lb.) while the birds in the laying group averaged 1723 grams (3.80 lb.). A large part of the difference can be accounted for by differences in the weight of the reproductive organs. The average weight of the ovary and ova of the dormant group was 4.91 grams (0.011 lb.) and in the laying group 51.76 grams (0.114 lb.) or an increase in weight of over 900 per cent. The average weight of the oviduct in the dormant group was 9.27 grams (0.020 lb.) and in the laying group 51.12 grams (0.113 lb.). This fact alone indicates that it would be impossible to draw any conclusions concerning the true relationship between external or internal body measurements or weights and annual production unless the birds are all in the same condition with respect to their reproductive organs. It is entirely possible, in fact probable, that the same group of birds weighed and measured at different times of the year may give entirely different results, when related to annual egg production, due to the fact that at one time of the year a larger or smaller proportion may be laying than at another time. This actually seems to be what occurs.

The birds used for the correlations of annual production with weight of bird in the two groups observed in the study on internal anatomy by Hall, are of the same strain and breeding as the birds studied by Asmundson and Moore, Table 10. In both cases where birds were used for comparison, all in dormant condition or all in laying condition, slight negative correlations with weight of bird and annual production were obtained, the correlations for the two groups agreeing very closely. On the other hand, both Asmundson and Moore obtained positive correlations with the groups of birds they studied, but the observations were made when some birds were laying and some were not, and if the measurements were taken in October or November, as some of them were, the best producers still being in production at that time would weigh more than the ones out of production due to their reproductive condition, and hence give a positive correlation with annual production, which would not be the case if the birds compared were all in laying condition, or all in dormant condition.

Again it is logical to conclude from the work done on internal anatomy that a bird may have a good body and not lay well; she may also have a large heart, large lungs, gizzard, intestine and liver, and yet not be an efficient producer because she does not have the inherited tendency, the urge to lay. If she does have the inherited factors for high egg production then she must have normal internal organs of good size in order that the factors for egg production may express themselves.

Souba (1923) working on the internal anatomy of cockerels, found that coefficients of correlation between the body weight and the weights of the different organs of one hundred Single Comb White Leghorn cockerels varies from 0.521 ± 0.05 to 0.801 ± 0.024. Correlations between the size of testes and size of comb and between the length of testes and length of comb, and between these characters and body weight are high, and indicate that from a knowledge of the body weight and development of the comb one can predict the sexual development of cockerels.

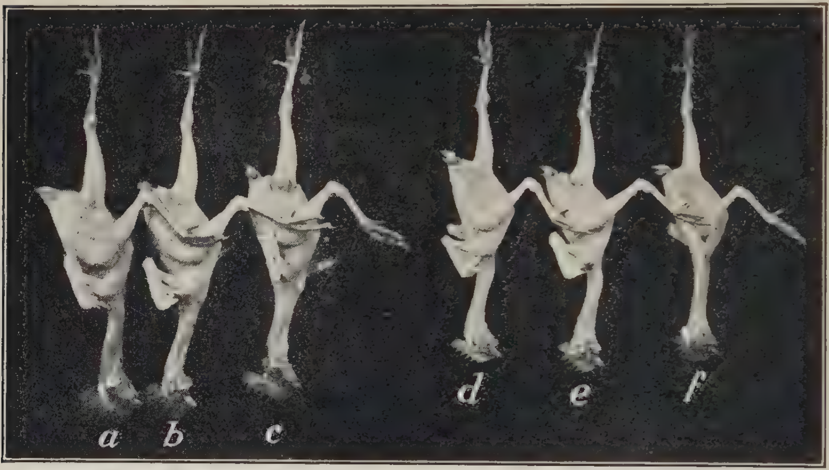


FIG. 91.—Differences in Comb Development (Secondary Sexual Characters) in Cockerels from High Production Lines and Low Production Lines.

The cockerels on the left are high line birds. Note the greater development of comb and wattles as compared to the low line cockerels on the right. The cockerels are of the same age. This difference disappeared in the adult males.

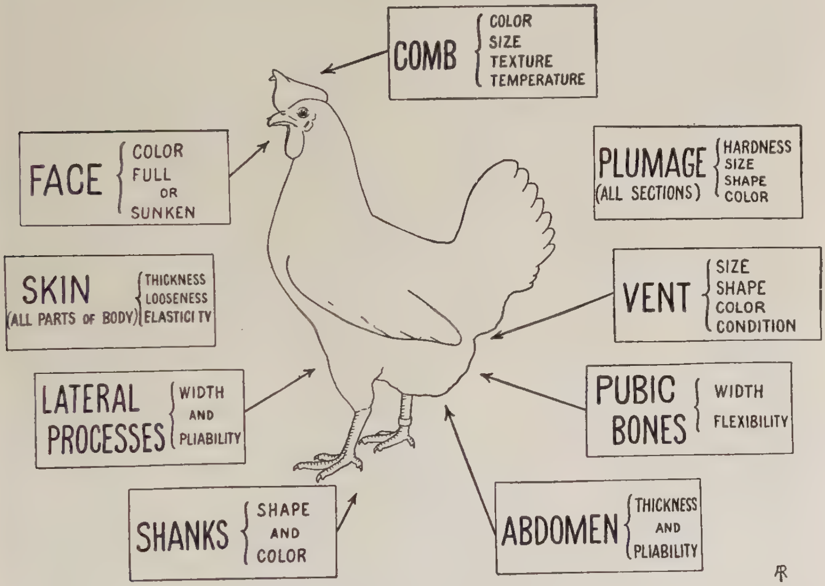
Heuser (1918) found that males with high-egg ancestry developed combs more rapidly than males with low-egg ancestry. (Fig. 91.) This difference disappeared as the males reached maturity.

PHYSICAL CONDITION

Physical condition is very closely related to what is commonly known as " handling quality " and reflects, for the most part, laying condition. (Fig. 92.)

Comb.—The comb is one of the best indications of the laying condition of a bird. The comb of a pullet will begin to expand and take on a red color before she lays her first egg and will be full, red and waxy at the time production begins. It will remain of good size until laying ceases, when it shrinks and becomes dry and scaly. (Plate I.) After the hen has recuperated and is ready to lay again the comb assumes very much the same appearance as it did when she began to lay as a pullet. The temperature and color of the comb will change very materially, depending upon whether the bird is quiet or in an excited condition.

Plumage.—Size, shape and color of plumage apparently have little relation to egg production. High-producing birds generally have more brittle feathers and hence more rough and broken feathers than do low producers which are continually renewing their plumage. High producers often have very close feathering for their particular variety.


COMB
COLOR
SIZE
TEXTURE
TEMPERATURE
FACE
COLOR
FULL
OR
SUNKEN
PLUMAGE (ALL SECTIONS)
HARDNESS
SIZE
SHAPE
COLOR
SKIN (ALL PARTS OF BODY)
THICKNESS
LOOSENESS
ELASTICITY
VENT
SIZE
SHAPE
COLOR
CONDITION
LATERAL PROCESSES
WIDTH
AND
PLIABILITY
PUBIC BONES
WIDTH
FLEXIBILITY
SHANKS
SHAPE
AND
COLOR
ABDOMEN
THICKNESS
AND
PLIABILITY
R

Courtesy Poultry Department, Cornell University.

FIG. 92.—Characters Indicating Physical Condition. (Handling Quality.)

Face.—The color of the skin on the face is an indication of laying condition, and reacts very much the same as the color in the comb. A clean-cut condition of the face is desired, neither too full or fat or too sunken. Thickness of skin may be indicated to some degree by the skin on the face.

Skin.—Thickness, looseness, elasticity and pliability of skin all indicate laying condition. Hens if laying heavily will have a very loose, pliable skin, which will thicken due to the accumulation of fat, and become hard and dry and very tight when a hen is not in laying condition, as illustrated in Fig. 93. The best hens have a thinner, more pliable skin than do low producers, if the two are compared when both are in or out of production. Work done by Hall at Cornell University shows that there is a rather close correlation between the thickness of the skin and thickness of the intestinal wall. Thickness of skin varies with different breeds, but within a breed or variety the thin-

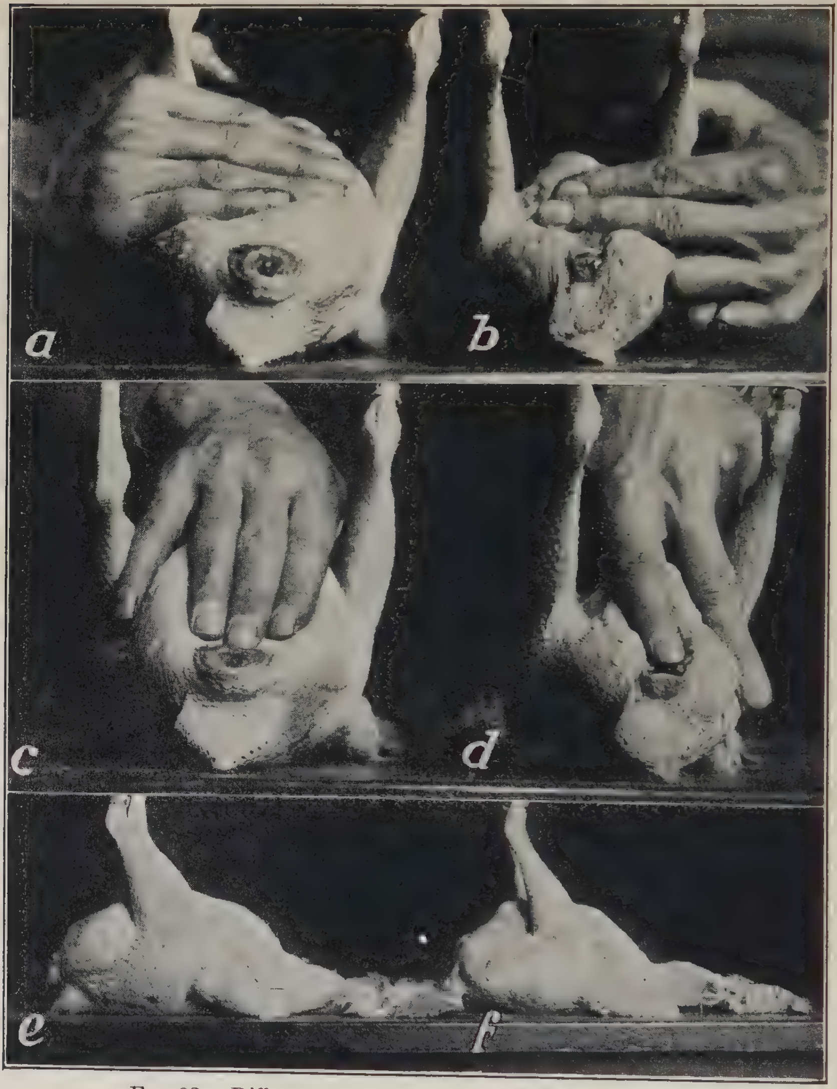


FIG. 93.—Differences in Birds Due to Laying Condition.

Bird (*a*) was in heavy production and may be contrasted to bird (*b*) in dormant condition. The laying bird has three fingers' width between the pubic bones (*c*), whereas the dormant bird (*d*) has only one finger width. (*e*) and (*f*) show side views of the same two birds. The front depth of the two birds is practically the same.

skinned birds are probably more efficient transformers of food material than are thick-skinned birds, whether it is for egg production or for the production of meat. Thickness of skin and quality of skin can be determined from the skin on the comb, breast or abdomen and size and smoothness of scales on the shanks. The velvety softness or roughness of the comb indicate varying degrees of skin quality.

Vent.—The vent is one of the very best indications of laying condition. A bird with a large, oval, dilated, moist vent is generally in a laying condition, while a bird in a dormant condition has a small, round, dry vent. The vent of the laying hen, if producing heavily, is generally white, or bluish white, while in dormant birds, of the yellow-skinned breeds, the vent is yellow. Fig. 93 shows the condition of the vents of laying and dormant birds.

The lateral processes, condition of pubic bones, distance between pubic bones and distance from pubic bones to rear end of keel change very materially with egg production, and therefore indicate laying condition as described under body type, page 166.

Abdomen.—The condition of the abdomen is one of the best indications of heavy laying capacity, as well as laying condition. A full abdomen, which is soft and pliable when grasped in the hand, is indicative of intensive production, as contrasted with the tucked-up, dry, hard abdomen of the low producer or dormant bird. A bird that is carrying a great deal of hard fat in the abdomen is not drawing upon the fat of the body very rapidly for egg production. The difference between the condition of abdomens in laying and dormant birds is illustrated in Fig. 93. A thin, loose, pliable skin over the abdominal region is desirable. A high-producing bird in heaviest production carries so much soft fat beneath the skin that the body will move freely within the skin if shaken when the bird lies on the hands.

The greatest difference in handling quality occurs between birds which are laying and those which are dormant, although the same general differences exist between low and high producers when they are all in laying condition or all in a dormant condition, but to a much less degree.

Shanks.—Large heavy scales on the shanks are indicative of coarseness, and are not usually found on the best producers. Body type and handling quality while of great importance are but two of the many factors to be considered in judging birds for egg production and should be used in connection with other characters in placing final judgment on a bird.

CHAPTER IX

THE DISTRIBUTION OF EGG PRODUCTION AS A FACTOR IN SELECTION

"Distribution of egg production" is the manner in which a hen lays eggs with reference to time. There are several factors which when taken together determine the number of eggs that a hen may lay in a year. These factors determine the distribution of the eggs during the year. The distribution factors may be divided into two groups: those operating directly and those operating indirectly upon egg production.

The direct factors are eight in number and may be classed as environmental. They include housing, feed, management, temperature, sunlight, humidity, time of hatching and diseases and parasites. These factors are discussed in Chapter X.

There are eight factors operating indirectly upon egg production:

1. Sexual maturity.
2. Cycle.
3. Rhythm.
4. Winter pause.
5. Persistency.
6. Broodiness.
7. Breed.
8. Age.

SEXUAL MATURITY

When a pullet lays her first egg she is said to have reached sexual maturity (precocity). This does not mean that the pullet has reached physical maturity. She may not lay until she has reached her maximum size so that sexual and physical maturity come together. However, most pullets reach sexual maturity several weeks before they attain their maximum pullet weight.

Early sexual maturity, or the tendency to produce eggs at an early age, is very definitely correlated to annual egg production. By annual egg production is meant the number of eggs laid by a hen in 365 consecutive days from date of laying her first egg. Table 11 shows the distribution of egg production for three years of a group of 166 Single Comb White Leghorns. This table illustrates the fact that pullets which began laying at an early age were the best producers the first year,

TABLE 11

SELECTING FOWLS ACCORDING TO SEASONAL DISTRIBUTION OF EGG PRODUCTION BY FOUR FACTORS. PRECOCITY, PERSISTENCY LENGTH AND TIME OF LAYING PERIOD

Two Methods of Leg Banding 166 S. C. W. Leghorns at Cornell University

PRECOCITY				PERSISTENCY										
	Laid First Egg Pullet Year	Average Age in Days at First Egg	Color of Leg Band Left Shank	Laid Last Egg First Year	Color of Leg Band Right Shank	Length of Laying Period in Days	Number of Birds	Production First Year	Value First Year's Production	Production Second Year	Value Second Year's Production	Production Third Year	Value Third Year's Production	Grade Based on Three Year Record
Flock I Laying first egg before 8 months and last egg after Sept. 1	Before 6 mo.	180.0	Blue	Nov. or Later	Blue	408.0	1	230.00	6.81	146.00	4.09	163.00	4.22	Breeders
	6–7	200.4	Red	Sept.	Green	291.0	18	154.44	3.96	138.78	3.38	117.44	2.74	1st Layers
	6–7	203.9	Red	Oct.	Red	309.3	22	176.04	4.71	139.86	3.30	122.77	2.88	Breeders
	6–7	201.9	Red	Nov. or Later	Blue	344.2	9	195.22	5.50	164.33	4.22	142.33	3.58	Breeders
	7–8	220.9	Green	Sept.	Green	277.6	15	150.73	3.72	128.00	2.91	115.33	2.57	2nd Layers
	7–8	226.3	Green	Oct.	Red	291.9	11	160.18	4.34	142.82	3.57	130.36	3.02	Breeders
	7–8	215.4	Green	Nov. or Later	Blue	328.2	5	161.20	4.29	139.80	3.35	122.40	3.00	1st Layers
Average, 81 birds......	48.7%	209.3	.....	....	....	303.3	81	166.20	4.40	140.62	3.40	123.88	2.91	
Flock II Laying first egg before 8 months and last egg before Sept. 1....	Before 6 mo.	175.0	Blue	Aug. or Before	Yellow	271.3	3	154.33	4.13	132.33	2.97	114.33	2.43	1st Layers
	6–7	198.1	Red	Aug. or Before	Yellow	258.9	22	124.45	3.11	110.91	2.50	99.23	2.17	1st Culls
	7–8	224.0	Green	Aug. or Before	Yellow	425.4	19	114.79	2.70	98.53	2.16	87.95	1.90	2nd Culls
Average, 44 birds......	26.7%	207.7	....	....	....	245.4	44	122.32	3.00	107.02	2.39	95.39	2.07	
Flock III Laying first egg after 8 months and last egg after Sept. 1.....	8–9 mo.	253.0	Yellow	In Oct.	Red	254.4	3	146.67	2.68	136.33	3.41	119.00	2.92	1st Layers
	8–9	253.0	Yellow	Nov. or Later	Blue	276.0	1	173.00	4.49	160.00	4.16	113.00	2.62	Breeders
	After 9	325.7	Black	Sept.	Green	169.2	6	81.83	1.86	122.67	3.09	110.00	2.55	2nd Culls
	9	298.0	Black	Oct.	Red	228.0	2	115.50	2.71	116.00	2.59	110.00	2.41	1st Cull
	9	301.0	Black	Nov. or Later	Blue	238.0	1	151.00	3.96	142.00	3.34	133.00	3.17	1st Layers
Average, 13 birds......	7.8%	297.2	......	....	....	211.3	13	114.31	2.77	129.15	3.19	114.08	2.67	
Flock IV Laying first egg after 8 months and last egg before Sept. 1.	8–9 mo.	253.6	Yellow	Aug. or Before	Yellow	200.0	18	98.06	2.18	116.33	2.72	106.78	2.39	2nd Culls
	After 9	301.2	Black	Aug. or Before	Yellow	139.4	10	76.20	1.61	91.50	2.01	75.60	1.51	4th Culls
Average, 28 birds.....	16.8%	270.6	......	....	....	178.4	28	90.25	1.98	107.46	2.47	95.64	2.08	
Key to Prices.....	....	......	.....	Jan. 45	Feb. 34	Mar. 25	Apr. 23	May 23	June 25	July 28	Aug. 34	Sept. 39	Oct. 53	Dec. 51

and that they continued to be the best producers for a period of three years.

Three different experiment stations, Massachusetts, Missouri and Cornell, reporting on the relationship between sexual maturity and egg production, based on the records of 2846 birds, covering a period of ten years, show very significant correlations between sexual maturity and annual egg production. This means that under normal conditions the less the number of days to date of first egg the greater will be the number of eggs laid in one year. Birds maturing extremely early are less desirable because of the small body size and egg size.

Sexual maturity shows a more positive relationship to winter production than to the production of any other season of the year. In considering sexual maturity it should be remembered that it is only one of several important factors affecting distribution and annual egg production.

Atwood (1923) has shown that early sexual maturity is correlated with the weight of the first few eggs laid, but that no correlation exists between early sexual maturity and mean egg weight of the pullet year.

CYCLE

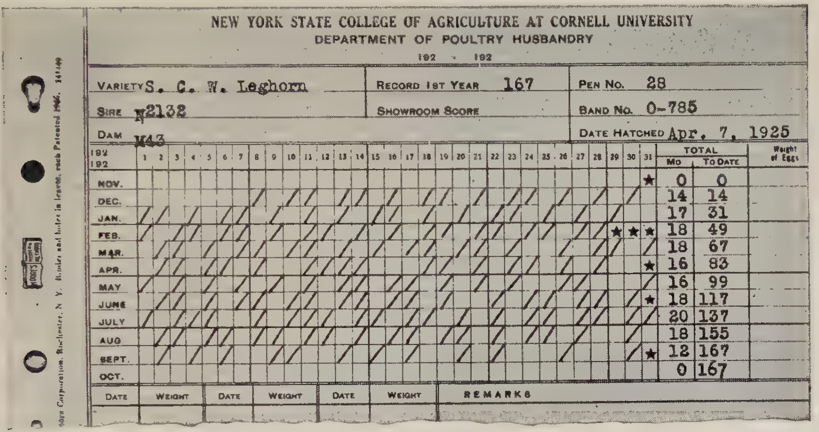
By " cycle " is meant the number of consecutive days during which a hen lays without a skip. Individual hens vary widely in their cycles. Although some hens may develop a very regular cycle, others never seem to be capable of maintaining a uniform number of eggs in their cycles.

Many hens, although developing a uniform cycle, have a short cycle and hence are relatively poor producers. Very few birds maintain a cycle of more than 10 eggs for a long period, but occasionally a hen will lay a cycle of 40, 50 or 60 eggs, or more. One hen at the Cornell Experiment Station laid 144 eggs without a skip, and one hen with a cycle of 220 eggs has been reported by Beall's Leghorn Farm. Fig. 94 shows a bird that laid 101 eggs in 101 days.

Courtesy D. Tancred.

FIG. 94.—This Hen Laid 101 Eggs in 101 Days.

The number of eggs in a cycle will very materially affect the number of eggs laid in a given time. A bird laying a one-egg cycle will lay 14 eggs in 28 days. If a bird lays in two-egg cycles she will lay 19 eggs in



NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
DEPARTMENT OF POULTRY HUSBANDRY
192 - 192

VARIETY S. C. W. Leghorn	RECORD 1ST YEAR 167	PEN NO. 28
SIRE N2132	SHOWROOM SCORE	BAND NO. 0-785
DAM M43		DATE HATCHED Apr. 7, 1925

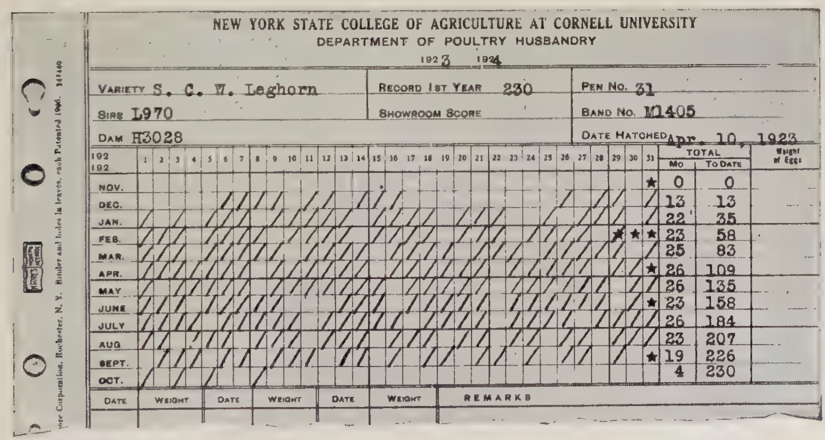
192 192	TOTAL Mo	TOTAL To Date	Weight of Eggs
NOV.	0	0	
DEC.	14	14	
JAN.	17	31	
FEB.	18	49	
MAR.	18	67	
APR.	16	83	
MAY	16	99	
JUNE	18	117	
JULY	20	137	
AUG	18	155	
SEPT.	12	167	
OCT.	0	167	

DATE	WEIGHT	DATE	WEIGHT	DATE	WEIGHT	REMARKS

FIG. 95.—The Record of This White Leghorn Hen Shows a Very Definite Rhythm.

She repeats her one or two egg cycles regularly with a skip of one day between each cycle.

the same period; with a three-egg cycle a hen will produce 21 eggs; with a four-egg cycle, 22 eggs; with a five-egg cycle, 23 eggs, and with a six-egg cycle 24 eggs in 28 days.



NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
DEPARTMENT OF POULTRY HUSBANDRY
1923 1924

VARIETY S. C. W. Leghorn	RECORD 1ST YEAR 230	PEN NO. 31
SIRE L970	SHOWROOM SCORE	BAND NO. M1405
DAM H3028		DATE HATCHED Apr. 10, 1923

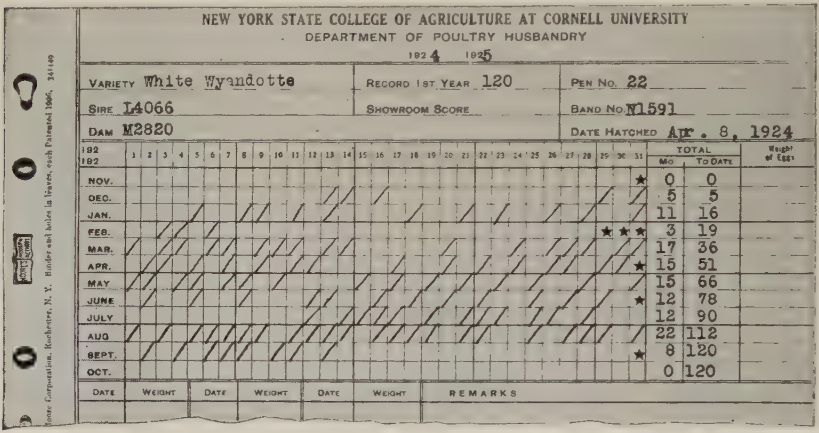
192 192	TOTAL Mo	TOTAL To Date	Weight of Eggs
NOV.	0	0	
DEC.	13	13	
JAN.	22	35	
FEB.	23	58	
MAR.	25	83	
APR.	26	109	
MAY	26	135	
JUNE	23	158	
JULY	26	184	
AUG	23	207	
SEPT.	19	226	
OCT.	4	230	

DATE	WEIGHT	DATE	WEIGHT	DATE	WEIGHT	REMARKS

FIG. 96.—A Record Showing Good Intensity from Month to Month.

Note the 4 to 6 egg cycles, repeated regularly during several months.

Unpublished data based on the annual records of 131 Single Comb White Leghorns at the Cornell Experiment Station shows a significant positive relationship between average cycle and annual production. This relationship, however, was not as significant as that between intensity of production of the three highest months of the year and annual egg production.



NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
DEPARTMENT OF POULTRY HUSBANDRY
1924 1925

Variety White Wyandotte
Record 1st Year 120
Pen No. 22
Sire L4066
Showroom Score
Band No. N1591
Dam M2820
Date Hatched Apr. 8, 1924

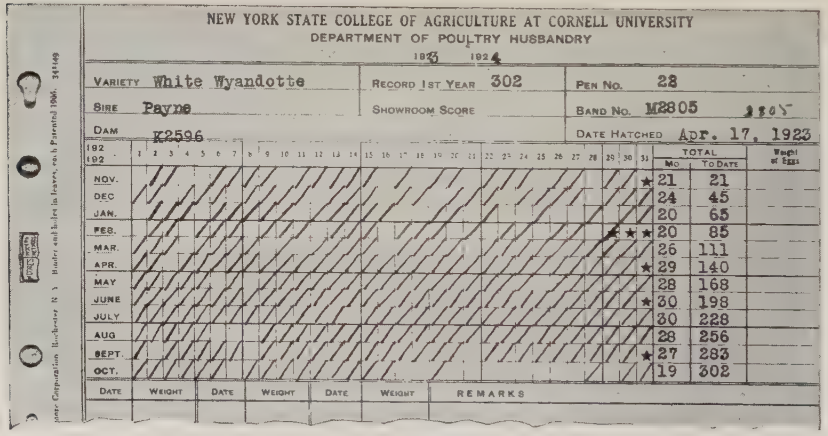
192 192	Total Mo	Total To Date	Weight of Eggs
Nov.	0	0	
Dec.	5	5	
Jan.	11	16	
Feb.	3	19	
Mar.	17	36	
Apr.	15	51	
May	15	66	
June	12	78	
July	12	90	
Aug	22	112	
Sept.	8	120	
Oct.	0	120	

Date	Weight	Date	Weight	Date	Weight	Remarks

Moore Corporation, Rochester, N. Y. Binder and holes in leaves, each Patented 1906. 341149

FIG. 97.—Record of a White Wyandotte Hen Which Did not Have a Definite Cycle or Rhythm.

She laid only 120 eggs in 78 cycles.



NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
DEPARTMENT OF POULTRY HUSBANDRY
1923 1924

Variety White Wyandotte
Record 1st Year 302
Pen No. 28
Sire Payne
Showroom Score
Band No. M2805 2805
Dam K2596
Date Hatched Apr. 17, 1923

192 192	Total Mo	Total To Date	Weight of Eggs
Nov.	21	21	
Dec	24	45	
Jan.	20	65	
Feb.	20	85	
Mar.	26	111	
Apr.	29	140	
May	28	168	
June	30	198	
July	30	228	
Aug	28	256	
Sept.	27	283	
Oct.	19	302	

Date	Weight	Date	Weight	Date	Weight	Remarks

Moore Corporation, Rochester, N. Y. Binder and holes in leaves, each Patented 1906. 341149

FIG. 98.—A Bird Which Lays 300 or More Eggs in One Year Does not Take Much Time for Rest.

This Wyandotte hen laid one cycle of 49 eggs. She required only 50 cycles to lay 302 eggs.

Fig. 95 shows the first year record of a Single Comb White Leghorn hen, number O-785, hatched April 7, 1925 (at the Cornell Poultry

Experimental Farm). This record illustrates a typical two-egg cycle individual, having only three cycles above 2 eggs during the year. The highest production reached by this bird during any one month in the year was 20 eggs. Compare this record with the cycle of hen number M-1405 shown in Fig. 96. This hen began laying at approximately the same time of the year as O-785 and stopped laying only a few days later, yet laid 63 eggs more during the same period of production. For three different months during the year, by laying four-, five- and six-egg cylces, M-1405 was able to lay 26 eggs a month, showing the very great importance of number of eggs in a cycle.

Fig. 97 shows the first-year record of N-1591, a White Wyandotte. This hen had no regular cycle.

Fig. 98, the first-year record of M-2805, the first 300-egg hen to be developed at Cornell University, shows what a hen must do to reach the 300-egg mark. This hen had only 50 cycles during the year to lay 300 eggs, while hen number N-1591, Fig. 97, took 78 cycles to produce 120 eggs. These two records illustrate very conclusively the importance of length of cycle.

RHYTHM

Cycle is very closely associated with " rhythm," a factor affecting very materially the distribution of egg production. By "rhythm" is meant the frequency with which cycles are repeated. Single Comb White Leghorn hen number O-785, Fig. 95, has a very definite rhythm. She repeats her one- or two-egg cycles regularly with a skip of one day between each cycle. Rhythm is well illustrated in the record of hen number M-1405, Fig. 96. Her four- to six-egg cycles are repeated regularly, with one day between each cycle. Hen number N-1591, Fig. 97, has a poor rhythm in addition to her short and irregular cycles. Her cycles are divided by periods of from one day to two or three weeks. While the cycles of hen number M-2805, Fig. 98, are very long for most of the year, they are repeated in a uniform manner.

If the rhythm of a hen is such that she lays one day and skips the second, she will generally lay about the same time each day. If on the other hand she lays two days out of three, she will generally lay the first egg of the cycle in the morning and the second egg in the afternoon, as 10, 3, 0, 9, 2, 0 o'clock.

Atwood draws the following conclusions with respect to rhythm and cycle:

" 1. The longer the cycle the shorter are the intervals between the laying of successive eggs.

2. The interval between the laying of the last two eggs of a cycle is usually greater than any other interval in the cycle.

3. The intervals between the laying of eggs at or about the middle of cycles are shorter than the intervals at either extremity.

4. As the birds become older the intervals between the laying of successive eggs become longer.

5. The shorter average intervals are usually associated with the more prolific layers."

WINTER PAUSE

Winter pause may be defined as the period when egg production ceases, following the termination of the winter laying period and previous to the initiation of the spring laying period. The winter pause is usually associated with a partial molt. Two distinct classes of pullets appeared in the flock studied by Hays (1926), namely, pause and non-pause. Hays has shown that winter pause is a characteristic detrimental to both winter and annual egg production. He found a negative correlation between the length of the winter pause and annual egg production in the group of birds exhibiting this character.

Winter pause indicates a lack of power to carry on. The pause is a rest period to enable a hen to catch up with her job of laying. It may be due to a lack of physical strength or a deficient fecundity factor.

PERSISTENCY

A bird's annual production is largely dependent upon two determining factors: the intensity of production or the number of eggs that she will lay in a given period of time, and the length of the laying period, that is, how fast and how long she will lay. The length of time that a hen lays in any one year is controlled on the one end by sexual maturity in case of pullets or recovery from the period of molt in case of older birds. At the latter end of the laying year we have a new factor which determines the time of cessation of production for any laying year. This factor is called "persistency," and by persistency we mean the continuance of production at the close of the laying year; that is, the late summer and fall months. A bird may be a persistent layer due to inheritance and yet not lay late into the fall due to unfavorable environmental conditions. A bird lacking the persistency factor is not likely to lay late even under the most favorable environment.

It is found that birds of low persistency lay few summer and fall eggs; that is, the annual production is distributed mainly over the winter and spring periods. A study of the material shown in Table

11, grouping 166 Single Comb White Leghorns into various flocks according to their persistency, will indicate the differences in annual production as affected by the time of cessation of production. In Flock I we find 81 birds which continued to lay until September 1 or later, thus giving an average laying period of 303 days. The average production of this group was 166 eggs in the first year, 141 eggs in the second year, and 124 eggs in the third year as compared with a production of 115, 99 and 88 eggs respectively in Flock II where the 44 birds ceased to lay prior to September 1. Inasmuch as all hens do not start to lay at the same time of the year we have another group starting later than either Flock I or II, but part of them ceasing to lay prior to September 1 and part continuing to lay somewhat later. Here we have an egg production of 114,129, and 114 eggs for 13 hens continuing to lay after September 1 as compared to an average production of 90, 107, and 96 eggs for those ceasing to lay prior to September 1. From this study, then, can be pointed out the importance of persistency in controlling annual production.

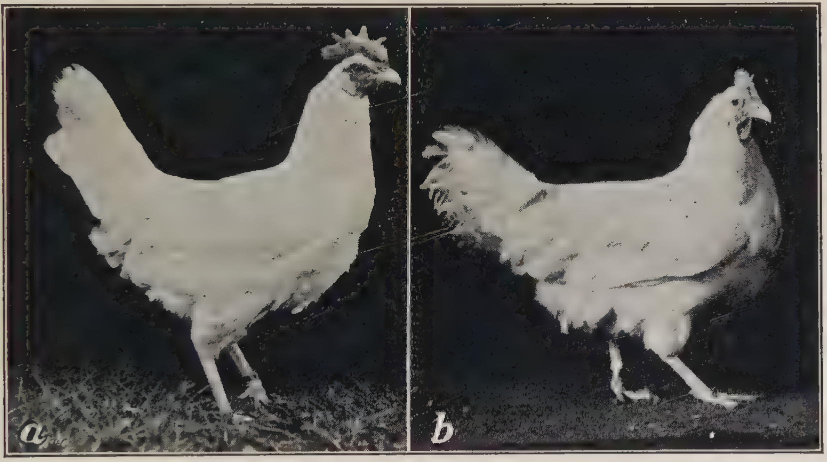


Fig. 99.—Two Long Distance Layers.

A3477 laid 1221 during a period of ten years.
M236 laid 1102 during a period of six years.

A bird to be a desirable layer or breeder should be prolific in her production for several years in succession and not for just her pullet year. Here, probably, is the best test of fecundity. Some hens will lay well for one or two years and then cease. Occasionally, however, we find birds that are so constituted that they continue vigorous and lay late year after year. As an example we may cite a hen at Purdue University that laid 1243 eggs in seven years or an average production of 177.4 eggs for that period of time. At Cornell University there are records of 31 hens that have reached 1000 eggs or more, some of these birds continuing to lay for eleven years, one of which laid 1221 eggs before she died. We should select birds, therefore, that have high fecundity as shown by persistency for many years, as well as for one year. Fig. 99 shows two of these persistent birds. Table 12 shows the records of fourteen 1000-egg hens.

TABLE 12

Production of a Group of Fourteen Hens, Each of Which Laid More than 1000 Eggs

(Cornell University)

Production by Years

Band No.	Year Hatched	1	2	3	4	5	6	7	8	9	10	Total
A3477	1909	148	159	144	146	91	131	121	122	87	82	1221
A7561	1910	164	137	117	129	132	129	118	121	73	....	1120
A8431	1911	146	134	126	131	111	124	123	100	120	....	1115
A8414	1911	166	156	135	128	144	137	118	106	37	....	1127
C6883	1914	143	100	107	126	112	148	120	105	106	....	1067
G 715	1918	209	180	198	179	164	140	50	......	......	....	1120
G 873	1918	235	163	147	145	129	116	59	42	......	....	1036
H 886	1919	153	164	160	153	176	148	62	19	......	....	1038
H2498	1919	203	190	183	168	164	151	34	......	......	....	1093
L3245	1922	215	167	141	147	139	94	112	......	......	....	1015
L3910	1922	220	184	179	193	182	121	75	......	......	....	1154
M 236	1923	274	209	182	155	137	107	......	......	......	....	1102
M4447	1923	223	219	171	168	143	142	......	......	......	....	1066
N3290	1924	225	207	200	195	177	......	......	......	......	....	1004

INTENSITY

Intensity of production is commonly understood to mean the number of eggs produced in a given length of time, as one month, two months or three months. In a similar manner the number of eggs laid during the winter, spring or summer months may be spoken of as the winter, spring or summer intensity. Intensity, as well as rate of production as measured by cycle and rhythm, can be accurately determined only by the use of the trapnest. It has been demonstrated by many investigators that a strong relationship exists between annual production, and the production of the various seasons of the year. Knowing this fact makes it possible to predict past or future production with a rather high degree of accuracy, or to predict annual production from the production of a relatively short period during the year.

The production for any month in the year shows a positive correlation with annual production. Some months show a much closer relationship than others. Reports based on 443 Single Comb White Leghorns trapped at the Vineland Egg-laying Contest, Vineland, N. J., show that prediction of annual production will be more accurate if the prediction is based on the production for any of the winter or fall months rather than the production for any of the spring or summer months. If the prediction is based on the production for three months instead of one it will be more accurate. Winter intensity has been shown to be a very accurate measure or period for predicting annual production. The relation between the production for a short period during the year and annual production holds true not only for the first year but for the second laying year as well, and it is safe to assume that it would continue for several years.

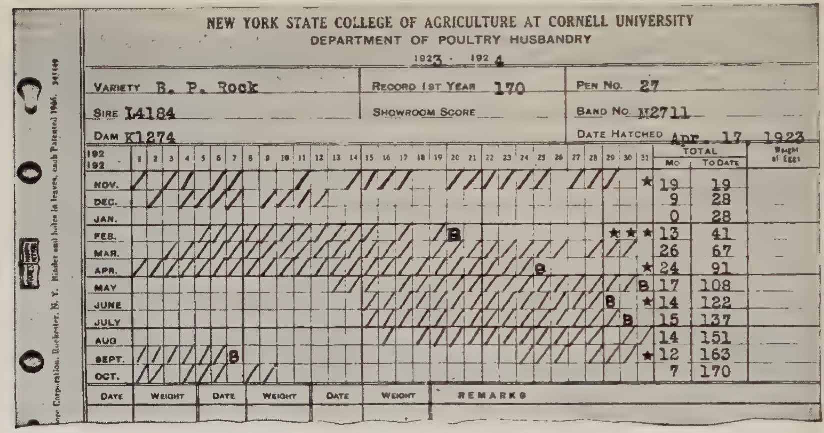
A statistical study of egg production of 403 Single Comb White Leghorns at the Cornell Experiment Station showed that the length of the laying period, as measured from date of first egg to last egg, and which is determined by sexual maturity, or age at first egg, and persistency or late fall laying, is the best measure of annual production. There is no great difference in the value of sexual maturity, intensity, and persistency as a measure of annual production. Hays (1927) in working on nine years' data on Rhode Island Reds at Massachusetts shows a high net correlation between persistency and annual egg production.

Most of the work that has been reported on the relationships of the egg production for various seasons of the year and annual production, and the inter-relationships of the production for various seasons or months during the year, has dealt with White Leghorns, but the same presumably is true of other breeds.

BROODINESS

Broodiness is the tendency of female birds to incubate their eggs. It is an individual characteristic. The broody factor may or may not be present in any particular bird. Breeding methods have almost entirely eliminated this disturber of production in most of our strains of Leghorns, but in many strains of our heavier egg breeds and in some Leghorns this factor is still present and exerts a limiting influence upon egg production. Broodiness is very intimately connected with egg production, and other factors such as cycle and rhythm. Its presence or absence influences the number of eggs laid and the distribution of those eggs over the laying year. This is because its presence causes production to cease for a period of time. A bird may exhibit the broody tendency only once in the laying year, or several times, these intervals being separated by short periods of egg production. The Massachusetts Experiment Station reports that a hen may not show the broody tendency in her pullet year but may develop such a tendency in her second or later laying year.

Broodiness affects the distribution of production by causing periods of complete cessation of production. It also results in a slightly higher rate of production during such times as the bird is not broody as compared to birds not going broody. As a result we get a high rate of production followed by complete cessation. This is particularly well illustrated in the egg record of a Barred Plymouth Rock, M-2711, as shown in Fig. 100. The first broody period came in February and it lasted for 13 days. It was followed by a period of high production, the bird laying 50 eggs in 53 days. Then followed another broody period of 19 days with a period of production at a high rate (17 eggs in 18 days) separating it from the third broody period. This lasted 15 days, and was followed by a 14-egg cycle, a 16-day broody period, a 15-egg cycle, a 17-day broody period, a 22-day period of production in which 20 eggs were laid, a 17-day broody period followed by a 16-day period of lower production and then complete cessation. Birds going broody several times in the course of a year do not as a rule stay out of production for quite as long a period as do birds going broody but once in a year.



NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
DEPARTMENT OF POULTRY HUSBANDRY
1923 · 1924

Variety B. P. Rock
Record 1st Year 170
Pen No. 27
Sire 14184
Showroom Score
Band No. M2711
Dam K1274
Date Hatched Apr. 17, 1923

192 / 192	Total Mo	Total To Date
Nov.	19	19
Dec.	9	28
Jan.	0	28
Feb.	13	41
Mar.	26	67
Apr.	24	91
May	17	108
June	14	122
July	15	137
Aug	14	151
Sept.	12	163
Oct.	7	170

Date | Weight | Date | Weight | Date | Weight | Remarks

Fig. 100.—Broodiness Often Affects Annual Production Very Materially.
Note the high intensity of this hen between broody periods.

The Massachusetts Experiment Station reports that Rhode Island Reds showing the broody tendency have fully as high and in fact slightly higher winter records than do those birds not going broody. Hence the elimination of broodiness has had but little significance in breeding for high winter production. However, it has had a very pronounced significance in breeding for high annual records due to its effect upon summer production.

BREED DIFFERENCES

The distribution of egg production is also materially affected by the breed. Several years ago the Storrs Experiment Station made a very detailed study of the distribution of egg production of four of our more popular breeds, namely, the Leghorns, Plymouth Rocks, Rhode Island Reds and Wyandottes. Data from the Storrs' Egg-laying Contest records were used in this study. In the White Leghorn study 1387 birds entered at the contest during the five years 1911–1916 were involved. The other three studies involved all of the birds completing the contest during the nine years 1911–1919. Nine hundred three birds were considered in the White Wyandotte study, 655 birds in the Plymouth Rock study and 1132 birds in the Rhode Island Red study. The distribution of production for each of these four breeds is shown in Table 13 the percentage of the total annual production occurring in each month of the year being given.

TABLE 13

Per Cent of Total Annual Production Laid in Each Month of the Year

(Data taken from Connecticut Bulletin Numbers 91, 117, 118 and 122)

	Leghorns	Wyandottes	Rocks	R. I. Reds
November	3.24	2.87	2.08	2.31
December	3.87	5.12	4.74	4.66
January	3.49	6.53	6.03	6.64
February	6.35	7.91	7.22	8.60
March	11.29	11.15	11.43	12.13
April	12.18	11.30	11.89	12.03
May	13.52	11.29	12.28	11.79
June	12.88	10.19	10.57	10.14
July	12.18	9.17	9.61	9.30
August	11.00	9.36	9.70	8.79
September	7.11	8.79	8.89	8.11
October	2.86	6.30	5.56	5.47
Total	99.97	99.98	100.00	99.97
Number of birds involved	1387	903	655	1132

The Connecticut Agricultural College pointed out in these bulletins that the four breeds studied showed important differences as regards the time they began to lay, the time of the year that they reached the highest production, and the time of the year that they ceased production. It was found that the Leghorns were slow to start in laying in November, December and January, but that they jumped up rapidly in production in February and continued at a high rate during the hot summer months of July and August, then dropped very low in October. This holding up in the late summer and early fall was probably partially due to the fact that they did not go broody to the same extent as the heavier breeds. The three American breeds laid heavier during the winter months of December, January and February, but they did not reach as high a peak in the spring months as the Leghorns. Also they dropped off very gradually in the fall months and in October at the end of the laying year they were considerably above the Leghorns in production.

It will be noted that the Rhode Island Reds reached their peak of production in March, the Rocks and Wyandottes in April, whereas the Leghorns did not reach their peak until May. For the month of November the Leghorns laid more than the other three breeds, due probably to the effect of earlier sexual maturity. The Wyandottes led during the months of December and January, the Rhode Island Reds during February and March, and the Plymouth Rocks during April. Then the Leghorns went ahead and led until September when the Wyandottes again assumed the lead.

It should be remembered that when we vary the management conditions, as by the use of artificial light for example, the distribution as regards the time of the maximum production will be changed materially, no matter what the breed or variety may be.

AGE

No discussion of the distribution of egg production is complete without some mention of age and its effect upon the distribution. Work done at the Utah Agricultural Experiment Station indicates that age up to three years at least has no direct effect upon the distribution of egg production. Indirectly, age does have an effect because as age increases the annual production ordinarily decreases, thus modifying the distribution. The length of the laying period tends to shorten and the rate of intensity ordinarily will decrease slightly. However, in case of birds of flocks of varying ages, where the total annual production is approximately the same, no distinct differences were noted in seasonal distribution or monthly egg cycles through the year. This appears to hold true regardless of whether low or high individuals or flocks are compared.

CHAPTER X

INFLUENCE OF THE ENVIRONMENT ON PRODUCTION

THIS chapter points out how the environmental factors influence annual egg production and the distribution of eggs throughout the year. Chapter IX discussed primarily the ways in which inherited characters influence or are influenced by the distribution of egg production.

Since egg production is a reproductive function and reproduction involves the survival of the species, it follows naturally, according to the most generally accepted theories of the development of individuals, families and species, that the best fitted would survive. One of the best indications of fitness to survive would be responsiveness in production to conditions which would be favorable for the hatching and rearing of young. The offspring of such responsive birds in the wild state survived. The others less responsive did not survive. Hence it is that our domestic fowls have retained many of their original characteristics, one of the chief of which is to lay when the conditions are favorable, and cease production when they are unfavorable. The secret of control of production through environment is to imitate as nearly as possible the most favorable nesting conditions. These occur at different times throughout the world, depending on sunshine, temperature, humidity and food supply, which vary with altitude, latitude, longitude, exposure, shelter, etc. (Fig. 101.)

These factors have profound influence on production. Hence the time of year and the conditions under which birds are, and have been, kept must be known if the most accurate judging for production is to be done.

The environmental factors to be considered especially are:

1. Sunlight.
2. Temperature.
3. Humidity.
4. Housing.
5. Feeding.
6. Artificial illumination.
7. Diseases and parasites.
8. Time of hatching.

Environment comprehends all of those factors which have to do with the health and comfort of the birds. It is difficult to segregate

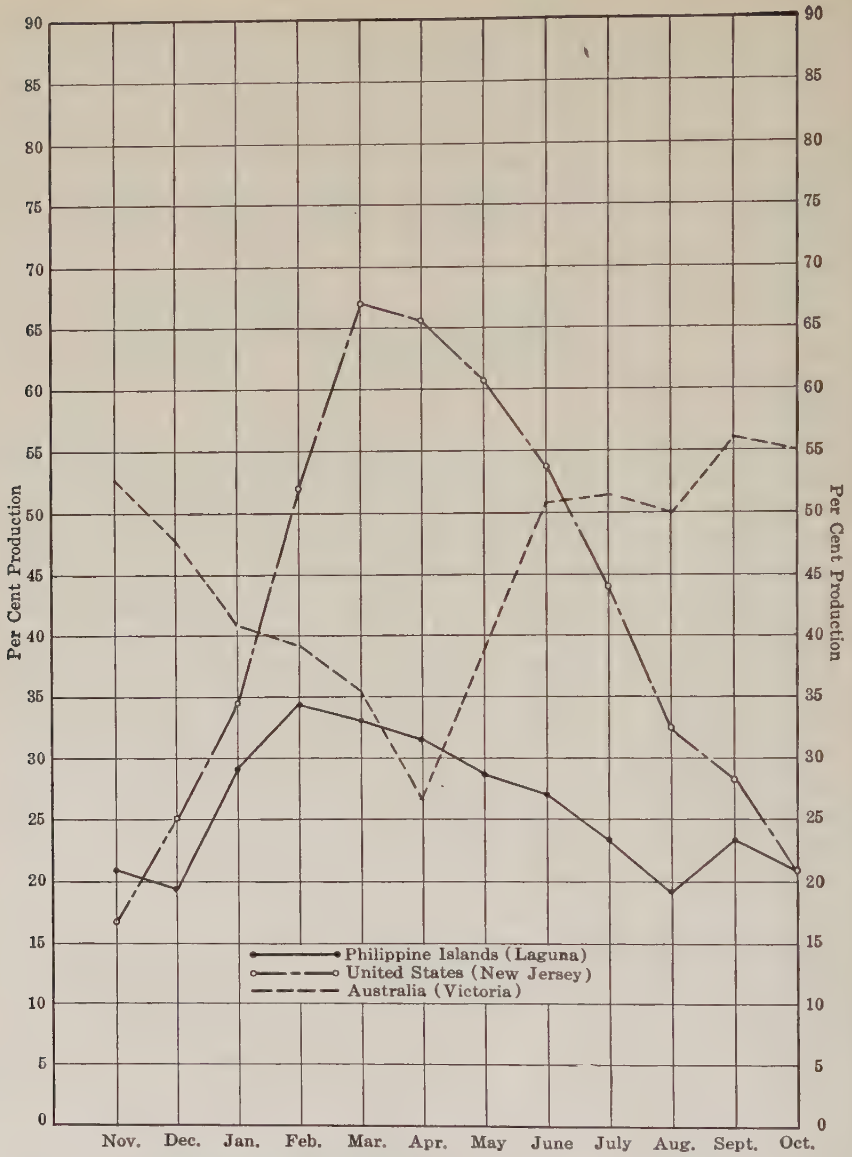


FIG. 101.—Egg Production May Vary Greatly in Different Parts of the World at the Same Time of the Year Due to Seasonal Climatic Variations.

these factors and discuss them singly because they are so closely interrelated and involved.

Perhaps the most far-reaching in its influence is that of climate, since it is an exceedingly variable factor between extremes in various parts of the world where poultry is kept, and because it embraces within its sphere of influence, directly or indirectly, every factor in egg production.

SUNSHINE AS AN INFLUENCING FACTOR ON DISTRIBUTION OF EGG PRODUCTION

Sunshine is the chief element in climate. Its heat, light, ultraviolet and other rays produce profound effects upon growth and value of crops for feed, the kind of houses to be built and the management of the birds during the various seasons of the year. Since birds, perhaps more than any other kind of animals, are influenced in production, growth, and reproduction by environment, it is not at all surprising to find that the production judge must have environmental influences constantly in mind when placing awards.

Within the past few years new discoveries have been made which indicate that the amount of sunshine available for use by the laying birds has a very marked effect upon production. The ultraviolet rays of sunshine apparently are essential for the best egg yield. These rays are not able to pass through ordinary window glass in large amounts. Only a very small percentage of the ultraviolet light can pass through ordinary window glass and only twenty-five or thirty per cent can pass through the better of the various glass substitutes. It may be seen then that by closing up tightly the front of the house with any kind of glass the larger part of these ultraviolet rays are shut out. Also it is evident that in those sections of the country where the amount of sunlight is limited, due to the heavy fogs overlying the land, or to cloudy conditions at certain seasons such as are experienced in many parts of the country, egg production may be lower unless overcome by special management than in other regions where conditions are more ideal in this particular respect. A comparison of the average yearly percentage of sunshine, and the fall and winter average percentage of sunshine, in five different cities of New York State will illustrate how the amount of sunlight may vary within a fairly limited area.

It will be noticed that the average percentage of sunshine in the fall and winter is much lower than that of the entire year, indicating the wide variation between the amount of sunshine during the various parts of the year. Inasmuch as the period of small amount of sunshine comes at the same time of the year as does the cold winter weather it is diffi-

City	Per Cent Sunshine	
	Yearly Average	Fall and Winter Average
New York	59	56
Albany	50	44
Canton	47	39
Buffalo	48	35
Ithaca	44	34

cult to separate the effect of these two climatic factors so as to determine the exact amount that each affects egg production. Table 14 will indicate how widely the percentage of sunshine varies in different sections of the country.

TEMPERATURE AND ITS INFLUENCE ON DISTRIBUTION OF EGG PRODUCTION

Of the climatic factors, temperature next to sunshine probably has the greatest effect upon the distribution of production and the total production. We must keep in mind that temperature itself is affected by such factors as elevation, latitude, proximity to large bodies of water and the contour of the land surface. It is quite evident then that we can get, and actually do get, a wide variation in temperature in dif-

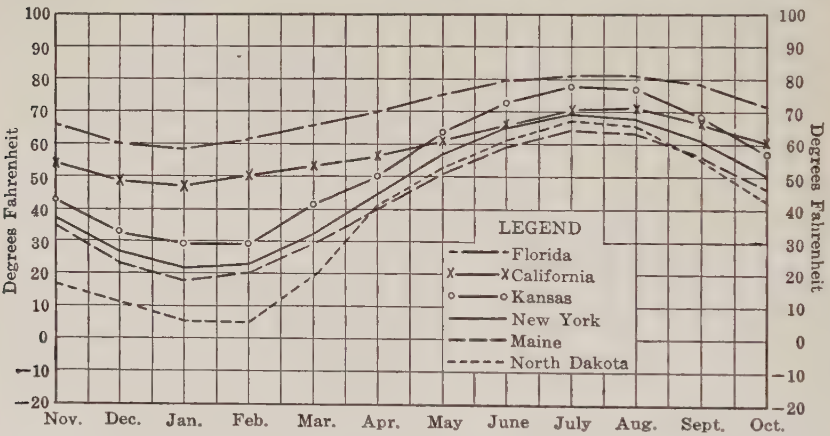


FIG. 102.—Temperature Is One of the Most Important Environmental Factors Affecting Egg Production.

Different states vary greatly with respect to this factor. Taken from thesis by H. H. Good.

ferent parts of a state and even within the range of a few miles. Likewise we get distinct variations between states due to differences in those factors which themselves regulate the temperature. (Fig. 102 and Table 15.) In an unpublished thesis by H. H. Good at Cornell University the following deductions were drawn as the result of a study of temperature conditions and the average monthly egg production obtained in the forty-eight states of the Union.

TABLE 14

Variations in Sunshine in Different Sections of the United States

Amount of sunshine is expressed in percentage of possible sunshine

(Data from Climatological Data, Bulletin W, United States Department of Agriculture Weather Bureau, 2nd Edition, Vols. I, II and III, 1926.)

Station	Spring Mar.–May	Summer June–Aug.	Fall Sept.–Nov.	Winter Oct.–Dec.	Annual Mean
California, Los Angeles	66	67	77	76	72
Washington, Seattle	34	52	57	25	42
Nebraska, Omaha	56	61	68	56	60
Iowa, Charles City	55	63	70	50	60
Texas, San Antonio	54	62	72	56	61
Missouri, Columbia	56	67	71	60	63
Wisconsin, Madison	50	58	64	43	54
Indiana, Fort Wayne	46	60	67	41	54
Tennessee, Nashville	48	66	70	55	60
Florida, Miami	66	65	66	61	64
South Carolina, Charleston	60	70	64	66	64
New Jersey, Trenton	54	58	63	54	57
New York, Canton	45	54	58	32	47
Massachusetts, Boston	55	60	63	51	57
Maine, Portland	57	58	62	53	58

1. " Either hot or cold weather affects egg production very materially, but the extent varies considerably.

2. Hot weather affects production, varying with the degree of intensity in respect to climatological adaptations.

3. Cold weather affects production radically when temperature changes are variable and extreme, but a moderate change or constant cold does not affect it so intensely.

4. Hot weather probably has a greater effect than cold weather.

5. The effect of temperature seems to be the same for either hens or pullets and high or low producers.

TABLE 15

VARIATIONS IN TEMPERATURES IN DIFFERENT SECTIONS OF THE UNITED STATES

Temperatures given in degrees Fahrenheit

(Data from unpublished thesis, Cornell University, by H. H. Good, and Yearbook of Agriculture, 1927, U. S. D. A.)

Station	Mean of the Maxima		Mean of the Minima		Normal Annual Mean
	Winter	Summer	Winter	Summer	
California, Los Angeles	65	73	44	56	62.4
Washington, Seattle	47	70	34	50	51.0
Nebraska, Omaha	33	84	15	65	50.6
Iowa, Charles City	25	82	9	59	48.1
Texas, San Antonio	64	93	45	72	68.9
Missouri, Springfield	43	85	26	66	55.7
Wisconsin, Madison	26	79	12	61	45.8
Indiana, South Bend	33	83	18	61	52.7
Tennessee, Nashville	49	87	32	68	59.3
Florida, Miami	75	89	59	75	74.4
South Carolina, Charleston	58	87	44	75	66.0
New Jersey, Trenton	38	81	26	64	52.5
New York, Ogdensburg	28	77	10	58	44.0
Massachusetts, Boston	37	78	21	61	49.6
Maine, Lewiston	30	77	11	57	39.2

6. Possibly the average optimum temperature is around 60 degrees Fahrenheit, while for the northern climate this figure may vary from 50 to 60 degrees and for the southern climate from 60 to 70 degrees.

7. Temperature is one of the deciding factors as to when the peak of production comes."

The effect of temperature is in most cases an indirect rather than a direct effect. The influence of a protracted hot spell in midsummer is toward a much lowered dry mash consumption. A similar effect is produced during a severe cold period in winter.

Such extremes in temperatures frequently account for slumps in production, premature molting, unusual changes in pigment, body condition, comb color, size and texture; and likewise all other physical characters by which one judges for production. Because of these disturbing elements the caretaker should be able to judge better of the value of his birds than one who is unfamiliar with their environment.

Cold weather lowers egg production and their normal food consumption by decreasing the activity of the birds. It is very noticeable that birds tend to stay on the perches or huddled together in corners of the poultry house on extremely cold days. Therefore they do not take into the body as much feed as they normally would consume on a mild day. Likewise more food material is probably needed to maintain the body heat on extremely cold days, thereby decreasing the amount available for egg production. In preliminary work carried on at Cornell University and reported in an unpublished thesis by Huttar (1928) a very close relationship was found to exist between the temperature on a particular day and the egg production three to four days later. Three days apparently were required for the full effect of the lower temperature to show on the egg yield. There was no apparent effect upon egg production of the day following an extreme cold night. Also birds whose combs were frozen did not apparently show any greater decrease of production than those with combs not frozen. Those birds with the largest combs usually lost a larger percentage of their combs by freezing than did those with smaller combs, yet they did not drop in production any more than did the smaller comb group.

The graph shown in Fig. 101 indicates the effect of temperature and other climatic factors upon egg production. Note the wide differences between the distribution of production obtained in three different countries. Fronda (1928) in discussing these egg production curves states, " The time of the year at which low and high production occur in these different places is perhaps explainable by the differences in the weather conditions and other environmental factors. It is very apparent that there is a definite period of productivity and a definite period of rest, and that these periods occur at definite parts of the year depending upon the surrounding conditions in the locality. The periods of reproductive activity and of rest in the United States occur at exactly opposite times of the year from those periods in Australia for the reason that when the weather is nice and warm in the United States, and therefore favorable for egg production, it is cold and dreary in Australia, and vice versa. Thus when the egg production curve rises in the United States, the tendency is to drop in Australia, and when the chickens are most actively laying in Australia, the chickens are going through their period of rest in the United States. Because both the United States and the Philippines are in the northern hemisphere, the different seasons of the year occur during practically the same parts of the year, and hence the egg production curves of the chickens in these two countries follow the same trend."

Card when comparing the curves of production and temperature for the Storrs Egg-laying Contest flocks for the years 1913–14 and 1914–15, makes the following comment: " The curve of egg production follows quite closely the curve of temperature. The sudden approach of cold weather in early winter is closely followed by a decided drop in egg production. The second cold snap coming three to five weeks later is likewise accompanied by a drop in egg yield. As soon as this cold spell breaks, the production curve climbs rapidly, keeping approximately parallel to the curve of temperature. Toward the end of the year as the hens begin to molt the production is cut down rapidly and its curve drops considerably in advance of the temperature curve."

HUMIDITY AND OTHER CLIMATIC FACTORS

The only other climatic factors that may affect egg production are humidity, snow and rainfall, and wind velocity. Probably none of these factors under normal conditions has any marked effect upon daily egg production when they are constant factors over a considerable period of time. The humidity may be high today, and low tomorrow, and the same is true of wind velocity. Results at the Cornell Experiment Station indicate that humidity has little or no effect upon egg production. The rainfall or snowfall probably has no effect unless the housing conditions are affected in such a way as to cause the moisture to gather within the poultry house. In such instances an indirect effect is often brought about through the channel of colds and disease.

Ordinary prevailing wind will have little effect except in cases where it disturbs the housing conditions. Where the birds are sufficiently protected from the winds by good insulation or windbreaks, either natural or artificial, there is little effect upon egg production. Very often the wind is accompanied by extreme cold or hot temperatures and in such cases the wind accentuates the effect of the temperature.

HOUSING AS AN ENVIRONMENTAL INFLUENCE

The conditions within the poultry house naturally will have a considerable effect upon the production of the flock. This is particularly so in the winter months. The way in which housing affects egg production has been partially touched upon in the discussions of temperature, moisture and sunlight. It should be pointed out, however, that entirely too large a number of our poultrymen are not arranging their houses to make the best use of the sun's rays or to control, insofar as it is possible to do so, the temperature and moisture within the house. In order to get the best use of sunlight during the winter months the windows should be opened or removed on the warm, sunshiny days. This will secure the maximum benefit of the ultraviolet rays for the laying flock.

Fowls should have opportunity each day for direct contact with the sun's rays when the sun shines.

The house should be well ventilated to allow for the complete removal of all the foul, damp air given off by the birds. It is desirable to have the house well insulated to keep out the cold drafts of winter weather. Also the floor should be well insulated in such a way as to prevent the ground moisture from working its way up to the surface of the floor.

The poultry house should be so located and constructed that the birds will not suffer from the extreme heat of the summer. Plenty of outlets for the used air and inlets for the fresh air are just as important during the hot summer months as during the cold winter months. Birds confined to the houses and not allowed on the range during the summer months will usually show deeper pigmentation than birds laying approximately the same production while on range. This often affects our judgment when handling birds under different housing conditions. These environmental factors rather than their inherited tendencies to high or low production may be responsible for birds slowing up or going out of production and causing marked changes in their physical characters.

FEEDING AS AFFECTING THE PHYSIOLOGICAL CONDITION OF LAYING HENS

Since the profit from the poultry flock depends to a large extent upon how many eggs the hens lay, the cost of feed being from 45 to 50 per cent of the total cost (including all labor and overhead charges) of the cost of producing eggs, it is essential to understand how feeding may influence production and the appearance of birds and in this way affect the judging of them. Hens must be given the right kind of feed in sufficient quantity not only to take care of body needs but also sufficient for the production of eggs. These two functions may go together or separately, one reacting upon the other.

Of all the environmental factors affecting egg production which can be *directly* controlled, feeding is the most important.

The effects of deficient rations fed to young chickens may materially influence egg production for life. Some experiments carried out at the West Virginia Experiment Station by Atwood (1923) indicate the following results:

"1. A poorly balanced ration fed to young chickens not only reduced the rate of gain in live weight but also reduced the mature weight of the females.

2. A poorly balanced ration fed to young chickens increased the

age of pullets before reaching sexual maturity, or in other words, before laying the first egg.

3. A poorly balanced ration fed to young chicks materially reduced the number of eggs laid by the pullets the first laying season, and to a slight extent the number of eggs laid during the second year.

4. A poorly balanced ration fed to young chicks had little, if any, effect upon the average weight of eggs."

It is found that each hen will consume from 75 to 100 pounds of feed a year, depending upon size and production and nature of the feed. Leghorns consume on the average about 80 pounds; Rhode Island Reds, Plymouth Rocks, and Wyandottes about 90 pounds; and the heavier breeds slightly more. As a rule it requires from 75 to 80 per cent of the feed to meet the maintenance requirements of a hen. The remainder of the feed, or only 20 to 25 per cent, can go toward new growth and production, that is, the increase of bone, muscular tissue, fat and eggs. In the case of the hen, reproduction is egg production. The number of eggs that a hen lays will depend directly upon the amount of feed consumed above that required for maintenance.

The hens, in order to produce efficiently, must not only have a sufficient quantity of feed but it must be of the right kind to meet the requirements for egg production. The hen's diet should consist of feeds which will meet the inorganic or mineral requirements for egg production as well as the organic requirements, that is, proteins, carbohydrates and fats. Since the egg contains 65 per cent water the importance of an abundance of fresh water, or liquid in some form, is evident. A lack of water will stop egg production entirely in a very short time.

Not only will the number and perhaps the size of eggs be affected by the amounts of the various elements and compounds necessary for egg production which are present in the feeds, but the kind and source of certain important compounds will materially affect results. For example, for best results at least a part of the protein requirement must be secured from an animal source such as meat scrap, tankage, fish meal, or milk products, instead of from a vegetable source. The amount and source of calcium is very important if satisfactory results are to be obtained.

Another important factor which will have a direct effect upon egg production is that of the vitamin content of poultry feeds. It has been clearly demonstrated that the lack of vitamins in the poultry ration will lower egg production very materially and may even cause cessation of production. For example, Table 16 shows the effect upon egg production of a ration deficient in vitamin D. It will be observed that birds receiving a ration deficient in vitamin D produce eggs which have

TABLE 16

Results of Experiments to Determine the Effect of Cod-Liver Oil and Sunshine upon Egg Production, Eggshell Strength and Other Factors. Vitamin D was Concerned in These Experiments

Poultry Nutrition Laboratory
(Cornell University)

Period	Control		Cod-Liver Oil		Ultraviolet Rays		Sunshine	
	Egg-Shell Strength, Pounds	Egg-Shell Ash, Grams	Egg-Shell Strength, Pounds	Egg-Shell Ash, Grams	Egg-Shell Strength, Pounds	Egg-Shell Ash, Grams	Egg-Shell Strength, Pounds	Egg-Shell Ash, Grams
1	9.53	2.97	11.26	3.15	11.11	3.20	9.90	Lost
2	8.71	2.75	11.59	3.16	11.15	3.07	10.21	3.06
3	8.56	2.65	11.84	3.19	11.44	3.15	11.20	3.09
4	5.15	2.12	11.02	3.10	11.13	3.16	10.12	3.12
5	4.51	1.86	11.15	3.05	11.68	3.04	11.07	3.02
6	3.41	1.69	10.82	3.04	11.02	2.96	10.82	3.04
7	2.93	1.74	10.93	2.94	10.87	2.87	10.56	2.91
8	4.49	1.68	9.28	2.86	10.27	2.96	9.50	2.83
9	2.79	1.60	8.12	2.73	8.58	2.79	8.40	2.70
10	2.93	1.68	7.68	2.67	8.14	2.80	8.58	2.76
11	3.94	1.84	8.71	2.80	9.02	2.69	8.51	2.84
Per cent ash in leg bones.....	56.72		61.00		62.21		62.88	
Average egg production......	39.9		160.00		156.7		179.80	
Average feed consumption..	59.3		74.26		78.58		77.18	
Average weekly weight.......	3.56		3.74		3.72		3.70	

weak shells and are low in ash content. The number of eggs is also materially decreased. Table 17 shows the vitamin content of a few important feeds.

The method of feeding is very important. Moist mash is often used to increase food consumption during the winter, late summer and fall months. This induces the birds to eat more food, thus increasing total consumption, and helps to hold the birds in production during the winter and late fall when the price of eggs is high. Varying the method of feeding with changes in temperature conditions from one season to another has its effects upon the distribution of production and the

TABLE 17

VITAMIN CONTENT OF SEVERAL IMPORTANT POULTRY FEEDS

Poultry Nutrition Laboratory, Cornell University.

Feed	Vitamins					
	A	B	C	D	E	G
Yellow corn	XX	XXX	O	—	XX	—
Wheat	O	XXX	O	—	XX	—
Oats	O	XX	O	—	XX	—
Rye	O	—	O	O	—	—
Skim milk	O	X	O to X	O	—	XX
Whole milk	XX	X	X	X	—	XX
Meat Scraps	O	O	O	O	—	—
Green grasses	XXX	XX	XXX	X	XXX	XX
Green alfalfa	XXX	XX	XXX	X	XXX	XX
Cabbage (white portion)	X	XXX	XXX	—	—	—

O Indicates no appreciable amount of vitamin.

X, XX, XXX } Indicates increasing amount of vitamin.

— Indicates evidence of vitamin content lacking or insufficient.

number of eggs laid. Feeds which produce fat and in turn energy in the form of heat are fed in greater quantities by most poultrymen during the winter season than in the spring and summer.

Green or succulent feeds, some of which are rich in vitamins, are of great value in keeping hens in good physical condition, which will have a direct effect upon egg production.

In culling a flock of hens it is always necessary to determine the feeding conditions as accurately as possible in order to pass accurate judgment upon them.

ARTIFICIAL ILLUMINATION AS A FACTOR AFFECTING DISTRIBUTION OF EGG PRODUCTION

Artificial illumination as a factor in the management of laying hens and the development of late hatched pullets is now accepted and used as a very general practice. This method of supplying extra working or feeding hours for the laying hen was practiced as early as 1889, by Dr. E. C. Waldorf, a practicing physician of Buffalo, New York. It is only within the past ten or fifteen years that the practice has been very widely used. It is worthy of universal adoption in wide regions of the country wherever the daily hours of daylight are less than 12 hours for any considerable period.

There are three direct results which may be secured by the use of artificial illumination: (1) a slight increase in the number of eggs produced by a flock of hens in one year; (2) the shifting of production from one season of the year to another, that is, from the season of low-priced eggs to the season of high-priced eggs; (3) aiding the growth of young stock or recovery after molting of mature stock. One or all of these benefits may be secured.

There are several methods of lighting used. Evening or morning illumination may be used or a combination of both evening and morning lights. Another method used is that of an evening lunch, generally lasting about one hour, usually from 8:00 to 9:00, or 9:00 to 10:00 P.M.

One of the important factors affecting total egg production is total food consumption. By the proper use of artificial illumination the total

TABLE 18

EFFECTS OF ARTIFICIAL ILLUMINATION ON THE DISTRIBUTION OF EGG PRODUCTION OF HENS

(Data from Cornell University, Ithaca, N. Y., 1918.)

Period	Per Cent Production			
	No Illumination	Illumination[1] 3 A.M. to Dawn	Illumination[1] Twilight to 9 P.M.	Illumination[1] 7 A.M. to 7 P.M.
Nov. 28–Dec. 25	1.7	34.0	28.8	11.4
Dec. 26–Jan. 22	5.0	30.4	36.8	22.9
Jan. 23–Feb. 19	18.6	29.3	36.4	38.1
Feb. 20–Mar. 19	31.3	28.4	42.7	45.9
Mar. 20–Apr. 16	54.6	32.9	52.6	57.9
Apr. 17–May 14	58.8	28.9	40.1	52.1
May 15–June 13	53.8	43.5	45.5	46.1
June 14–July 9	46.1	51.1	39.1	37.0
July 10–Aug. 6	43.0	45.5	44.5	35.7
Aug. 7–Sept. 3	33.3	18.0	37.8	24.1
Sept. 4–Oct. 1	11.9	8.9	24.6	13.8
Oct. 2–Oct. 29	.4	13.7	20.7	17.6
Average per cent	29.9	30.4	37.5	37.7

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[1] 3 A.M. to dawn started November 28, and continued to April 1; started again September 10, and continued until end of laying year. Twilight to 9 P.M. continued throughout year. 7 A.M. to 7 P.M., began November 28, and morning light continued to February 1, and evening light to April 1. Evening light started again in late August and continued until end of the year.

food consumption may be increased because the birds have more time to feed during the season of the year when the normal day is relatively short. Table 18 compares three methods of using artificial illumination on hens with hens not given illumination. Lights were used as shown in the footnote to the table. It will be seen that the production of the lighted hens was very much greater during the winter months than of the unlighted birds, but during the spring and summer months the conditions were slightly reversed, the unlighted hens giving the higher production. In the fall the lighted birds produced better than the unlighted birds.

TABLE 19

EFFECTS OF ARTIFICIAL ILLUMINATION ON THE DISTRIBUTION OF EGG PRODUCTION OF PULLETS

(Data from Cornell University, Ithaca, N. Y., 1918.)

Period	Per Cent Production			
	No Illumination	Illumination[1] 3 A.M. to Dawn	Illumination[1] Twilight to 9 P.M.	Illumination[1] 7 A.M. to 7 P.M.
Nov. 28–Dec. 25	22.4	57.0	16.0	21.6
Dec. 26–Jan. 22	23.1	49.5	47.6	30.5
Jan. 23–Feb. 19	31.8	36.9	52.9	44.1
Feb. 20–Mar. 19	49.9	38.9	53.6	55.2
Mar. 20–Apr. 16	63.0	34.0	52.6	57.8
Apr. 17–May 14	55.5	31.0	42.3	49.7
May 15–June 13	38.5	41.1	38.1	43.0
June 14–July 9	36.2	36.7	37.9	38.0
July 10–Aug. 6	27.0	29.6	36.9	37.0
Aug. 7–Sept. 3	17.3	12.3	27.5	28.4
Sept. 4–Oct. 1	9.2	10.4	23.1	16.3
Oct. 2–Oct. 29	7.7	25.0	20.8	21.9
Average per cent	32.0	33.5	37.6	37.7

[1] 3 A.M. to dawn started November 28 and continued to April 1; started again September 10, and continued until end of laying year. Twilight to 9 P.M. continued throughout year. 7 A.M. to 7 P.M., began November 28, and morning light continued to February 1, and evening light to April 1. Evening light started again in late August and continued until end of the year.

Table 19 shows the comparison of the same methods on pullets. Here there is both a distinct shift in production and a rather pronounced increase in total production. These flocks would present a different physical appearance than unlighted birds due to the difference in the number of eggs laid and brought about by the use of artificial light. Here the difference in production would be accounted for by environment rather than inheritance.

Artificial light, when properly used, is our most effective means of control of egg production in winter. When not properly used it may be a dangerous experiment. Some of the reasons why poultrymen do not get the results which they expect from artificial light is because they do not take into consideration the physical condition of the birds, as shown by their weight, the laying quality, as indicated by their appearance and breeding, the age of the birds and their molting and laying condition when deciding upon the method of feeding and illumination.

Diseases and Parasites.—The physical condition of the bird as regards freedom from disease and parasites has a very striking effect upon egg production. Such diseases as leg weakness for example, may be the result of the lack of sunlight or of some substitute for it or of malnutrition, or may be due to worms or chronic coccidiosis. Roup and colds are due to a large extent to the housing conditions or climatic factors. So most diseases are in the end the result of inefficiency in one or more factors of management. Fig. 103 shows a bird affected with roup.

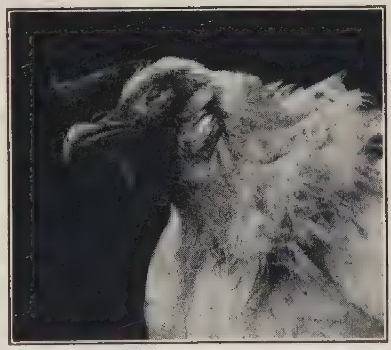

Fig. 103.—A Laying Hen with Roup.

A bird affected in this way cannot produce efficiently, and shows the effects of disease in pigment, molt and other physical characters.

Parasites living upon the bird or in the poultry house when present in large enough numbers will cut egg production very materially. It is not unusual to find flocks of birds that have ceased production entirely due to the heavy infestation of red mites. A bird in order to lay heavily must be free from such parasitic enemies or other handicaps. This is a controllable factor but many poultrymen do not watch the sanitary conditions closely enough to keep disease and parasitic enemies under control. Therefore, one must always have in mind the necessity of distinguishing between weakened or other physical conditions brought about by egg production as compared to influences due to diseases or parasites.

Time of Hatching.—The distribution of eggs and also the total annual production in the first laying year of an individual or a flock is influenced greatly by the time of year that the individual or flock is hatched. The effect of early or late hatching is undoubtedly greater in the first laying year than it is in the later laying years. The influence of time of hatching no doubt is due primarily to the environmental conditions as affecting rearing and subsequent production. Frequently the unfavorable conditions may be overcome so that the time of hatching becomes an unimportant factor. In those sections of the country where the widest extremes of seasons occur, the influence of time of hatching is greatest, and on the other hand in those regions having the most uniform and favorable climatic conditions there is much less difference. Upp and Thompson (1927) have shown that *spring* hatched individuals were older when production commenced than were those hatched at other seasons. Hays, Sanborn and James (1924) and Kempster (1925) pointed out that late hatching tends to reduce the length of growing period prior to laying. The findings of Knox (1927) are contrary to these results.

Upp and Thompson (1927) found a negative relationship between time of hatching and annual egg production, when these two characters were correlated for birds hatched in the summer and fall seasons. Table 20 shows the effect of season of hatching upon several characters used in judging.

TABLE 20

INFLUENCE OF TIME OF HATCH ON CHARACTERS USED IN JUDGING BIRDS

(Data from Bulletin 167, Oklahoma A. and M. College)

Season Hatched	Mean Body Weight, Pounds	Days to First Egg	Mean Weight 1st Doz. Eggs, Grams	Mean Annual Egg Weight, Grams	Annual Egg Production	Per Cent Mortality	Rest Period for Molt [1]
Early Winter......	3.02	156.4	36.35	48.70	160.0	19.0	98.0
Late Winter......	3.19	185.3	41.32	49.72	153.9	11.1	106.6
Early Spring......	3.13	236.3	48.60	50.48	154.3	6.6	96.1
Late Spring.......	2.97	233.7	48.92	49.62	145.5	7.3	100.5
Early Summer....	2.86	229.3	48.07	48.89	134.7	12.2	130.5
Late Summer.....	2.61	214.3	45.68	47.14	128.6	21.2	120.8
Early Fall........	2.53	195.5	41.80	46.35	109.8	16.6	139.9
Late Fall.........	2.62	178.6	40.35	46.96	121.1	21.2	135.2
All Groups.......	2.88	203.4	....	48.65	138.8	13.5	116.1

[1] This rest period refers to the annual molt at the end of the first laying year.

As shown by this table, birds which were hatched during the normal spring season took a longer period for sexual development and as a result had larger bodies, laid larger and a greater number of eggs and had a lower percentage of mortality during the first laying year.

CHAPTER XI

THE INHERITANCE OF EGG PRODUCTION

SINCE inheritance is perhaps the most important single factor affecting fecundity and physical characters, an understanding of inheritance and its influences is essential in order to place proper emphasis on external indications of production values. "Egg production," as the expression is commonly used, means the ability of a pullet or hen to produce eggs, and is generally measured by the number of eggs produced in one year from date of first egg laid in the case of pullets or from the first egg laid by a hen after recovery from molt. It is the expression of the natural reproductive tendency of the female. Production is a reproductive function.

Egg production is dependent upon many factors. These are both internal and external. Fowls bred intensively for high reproductive capacity will not lay their normal production without proper feeding, housing and management. On the other hand fowls which have back of them several generations of low-producing ancestors will not produce many eggs, even under the best possible environmental conditions. The environmental factors affecting egg production are described in Chapter X.

In order to lay well a hen must have not only the best possible external conditions, but must possess a vigorous constitution inherited from fowls bred for production, carrying the internal genetic factors for high egg production. The correct environmental conditions are necessary to enable the genetic factors to express themselves in the form of eggs. These facts show the importance of a combined knowledge of the manner in which egg production is inherited, of the genetic factors responsible for reproductive capacity and the management factors. Inheritance is first. It is the urge to lay. Management is second. It provides the conditions which supports the inherited tendency to lay. They are of equal importance since neither one can function without the other.

EARLY INVESTIGATIONS

Several investigators have demonstrated the fact that egg production is inherited. The fact was so apparent that it had been accepted as true by poultrymen for many generations. Pearl, in 1909, was the first to publish any data on this subject. His work was based on winter egg production of Barred Plymouth Rocks, at the Maine Agricultural Experiment Station. In addition to the basic factor F (femaleness), common to pullets, Pearl reported two other genetic factors, L1 and L2, which being present together, determine a high winter production of over 30 eggs. The presence of either of these factors alone gave only a low winter production of under 30 eggs, while the absence of both of these factors, according to Pearl, gave a zero bird, which produced no winter eggs at all.

An interesting and important complication reported by Pearl in the case of Barred Plymouth Rocks was that, while the factor L1 was inherited alike by male and female progeny, the factor L2 was sex-linked in the female. That is to say, when the female germ cells of the Barred Plymouth Rock are formed, the L2 factor is coupled with the factor for maleness, consequently the high-producing Barred Plymouth Rock hen according to Pearl does not transmit her L2 factor to her daughters, but only to her sons, and therefore the high-producing Barred Plymouth Rock pullets must inherit this high production factor from their sire and not from their dam.

From 1913 to 1915, some experiments were carried on by C. C. Hurst of England, which he states provided sufficient data to identify seven of the genetic factors concerned in the first year's production of White Leghorns and White Wyandottes, together with definite indications of other sub-factors of prime importance to a maximum egg production. The presence of two genetic factors which determine winter production in Barred Plymouth Rocks found by Pearl in his experiments were confirmed in both White Leghorns and White Wyandottes, with two important modifications. First, sex-linkage was not found to exist in either variety used in the experiments, the hens being able to transmit their high winter production factors to their daughters as well as to their sons. Second, Pearl's interpretation that the zero winter production in Barred Plymouth Rocks is due to the double absence of both L1 and L2 factors is not borne out either in the White Leghorns or White Wyandottes. Zero producers appeared in the White Leghorns, and some birds lacking both factors gave a low winter production in both varieties, whereas at the same time, at least three of the zero Wyandottes were found to be carrying one of the high winter production factors.

The seven pairs of genetic factors according to Hurst identified with the first year's production of White Leghorn and White Wyandotte pullets were as follows, the capital letters representing the *dominant* factors and the small letters recessive.

Dominant	Recessive	
1. E (Early)	e (Late)	Sexual maturity
2. W (Fast)	w (Slow)	Rate of winter production
3. S (Fast)	s (Slow)	Rate of spring production
4. M (Slow)	m (Fast)	Rate of fall production
5. H (Broody)	h (Non-broody)	Broodiness
6. N (Small)	n (Large)	Egg size
7. C (Brown)	c (White)	Egg color

Hurst presents data which might lead to the assumption that each one of these characters is due to a single pair of heredity factors or units; that is, one pair of factors or units is responsible for the inheritance of each different character. By a close study of the data it can be seen that there is wide variation for each character among the birds studied; for example, sexual maturity or time of laying first egg was very variable, among the birds tested, which indicates, at least, that several factors may be involved in the transmission of each one of these characters from parent to offspring. Experiments carried on by other investigators would indicate that some of these characters are inherited in a more complex manner than by a single factor hypothesis.

In December, 1912, some experiments were started by Dr. H. D. Goodale of the Massachusetts Agricultural Experiment Station upon the subject of the inheritance of egg production. It was then supposed that the inheritance of fecundity was a simple two-factor Mendelian matter, but it was not long before it gradually became clear that, with Rhode Island Reds, the egg record made by a bird was the result of the combined action of a number of heritable characters.

Stated in as simple a manner as possible, five main characteristics may be recognized according to Goodale:

1. Maturity.
2. Rate (intensity).
3. Broodiness.
4. Point at which production ceases (persistency).
5. Winter pause.

Each one of these characteristics was found to be extremely variable. With five variable characters to be considered (and possibly there are more) all the possible combinations with the resulting egg records, would be in the thousands.

However, some very interesting facts were observed by Dr. Goodale in connection with the records of different hens. In examining the records of the highest producing hens it was noticed that they began to lay early in life (and also fairly early in the season) and continued to lay at a steady and relatively high rate throughout the entire year. Examined from the negative standpoint, it was noted that in these same hens there were no broody pauses, no winter pause, no delay in beginning production, no early cessation of production, no slow rate of production while laying. On the other hand a low producer shows late maturity, early cessation and slow rate. The problem of the breeder then, is to devise a method of eliminating the undesirable characteristics from the flock and of securing fairly uniform high production.

As long as attention is fixed solely on the number of eggs laid, and no recognition given to the fact that the difference between a 150-egg hen and a 200-egg hen is something more than just 50 eggs, progress in getting at the fundamentals of the inheritance of egg production is hindered. The solution of the problem demands that the inheritance of each component shall be ascertained by specially planned experiments. This would require, according to Goodale, about fifty years of one man's time, with a flock of 500 pullets trapnested through their first laying year, for each of the fifty years.

The work with Rhode Island Reds confirms the work of Hurst, in that no sex-linkage was found in connection with the factors affecting winter egg production. Rice, as early as 1901, pointed out the fact that early sexual maturity was directly correlated with annual production. He used the term " precocity " in describing this character.

BROODINESS

Broodiness is the tendency of female birds to incubate eggs. The work done by Goodale, Sanborn and White of the Massachusetts Agricultural Experiment Station on broodiness indicates that its method of inheritance is more complex than described by Hurst. These investigators find that broodiness depends upon the presence of a " complete mechanism " in the individual, and that the absence of broodiness depends upon the loss of some essential part of this mechanism, or its inhibition by some secondary factor.

In the flocks studied, non-broodiness appears to result from the loss of one or both of two factors from the complete germinal complex, while there is some evidence that a dominant inhibitor may also exist in the germ plasm of these flocks. The inheritance of broodiness may be expected to vary from flock to flock.

By suitable breeding methods it has been found possible to develop quickly a strain of low degree of broodiness from a strain with a very high degree of broodiness.

Table 21 is taken from work reported by Hays and Sanborn, 1926, and illustrates what can be done in breeding broodiness out of a broody flock of Rhode Island Reds.

TABLE 21

THE ELIMINATION OF BROODINESS

Year Hatched	Birds Broody, Per Cent	Average Number of Broody Periods for Broody Hens	Total Number of Birds Available[1]	Annual Production
1912	89.60	4.4	125	114
1913	91.03	5.4	78	124
1914	85.95	4.3	121	103
1915	89.25	4.3	428	122
1916	86.31	3.5	431	134
1917	48.84	2.7	432	166
1918	61.40	2.9	215	169
1919	No annual records			
1920	46.03	2.9	126	200
1921	44.56	2.7	285	200
1922	28.91	1.9	399	200
1923	27.35	1.9	340	189

[1] This column indicates all Rhode Island Reds except intense broodies and in-breds.

Table 21 shows that the progress in eliminating broodiness has been two-fold: Reduction in percentage of broody birds and reduction in the mean degree of broodiness. It was noted in this work that the elimination of broodiness had little significance in breeding for high winter production but a very marked significance in breeding for high annual production.

There are several external indications of broodiness. Most hens cease production with the onset of broodiness. They remain on the nest and are generally vicious toward the attendant if disturbed. The broody hen almost always clucks. Some investigators have stated that when the eyelids form a distinct angle in the upper front corner of the eyelid it is a fairly sure sign that the bird will become broody. It is very doubtful if such a relation exists to the extent that it would be of any value in eliminating broodiness from a flock by physical examination.

SIZE, SHAPE AND COLOR OF EGG

Size, shape and color of egg have come to be of an importance equal to or possibly greater importance than that of the numbers of eggs laid. The two factors of size and shape of eggs may be spoken of as egg type. That egg type is inherited, in the same or a similar manner to other egg characteristics, has been made evident by several investigators. The work of Hurst has already been cited. Benjamin (1920), of the Cornell Experiment Station, worked for a period of three years on the subject of egg type and color, working especially with the inheritance of these characters. Benjamin did not attempt to analyze the factors, or physiological units, involved in the inheritance of these characters, but observed certain general lines of inheritance which give some evidence on which to base work for the improvement of poultry flocks, as follows:

Both the male and female appear to have a distinct and approximately equal effect on the type of egg production by the progeny, but the combined effect of the two was found to be much greater and was directly inherited by the progeny, as was shown by the type of egg produced. A mating of two opposite extremes of a character always caused the production of a medium condition for that character in the progeny.

Benjamin states that his results indicate that small size and length of egg are dominant characters, while there seemed to be no dominancy whatever for color, the color character being much more irregular than size or shape, and less reliance can be placed on the stability of any color type when selecting eggs for hatching. The tinted or pigment color factor is known in breeding practice to be so persistent that it will appear for many generations even though extreme care is exercised in selecting hatching eggs.

A strong correlation was found to exist between the types of eggs produced by individuals and the types of eggs from which these individuals were hatched. All of the eggs produced by any one hen tend to be of a characteristic type as to size, shape and color. It was also noted that certain individuals had the power to transmit their characters much more accurately than did others.

Table 22 shows the results in the progeny of various matings for the size, shape and color of eggs. In most all cases where two opposite extremes of a character are used the resulting character in the progeny is intermediate between the two. This would indicate that none of the characters studied by Benjamin are completely dominant, and also that the characters are due to more than one factor or physiological unit located in the germ plasm, as has been demonstrated to be the case for such a quantitative character as size of bird. (Punnett, 1914, Journal of Genetics.)

TABLE 22

Size, Shape and Color of Eggs

Character	Mating	Mean Character for Sire	Mean Character for Dam	Mean Character for Progeny
Size..........	Large sire and small dam	59.6	51.5	54.3
	Small sire and large dam	51.7	60.6	53.9
	Large sire and large dam	60.3	59.6	57.2
	Small sire and small dam	51.7	51.7	51.6
Shape.........	Round sire and long dam	73.0	69.3	71.5
	Long sire and round dam	67.0	75.4	72.5
	Round sire and round dam	73.0	76.0	75.0
	Long sire and long dam	65.4	69.1	71.0
Color.........	Brown sire and white dam	4.81	2.34	3.00
	White sire and brown dam	2.11	4.78	3.27
	Brown sire and brown dam	4.56	4.55	3.75
	White sire and white dam	2.34	2.19	2.60

As pointed out by Benjamin and Hurst, when a cross is made between a brown-egg race and a white-egg race, the progeny in the first generation produce eggs of an intermediate tint. An attempt was made by Punnett and Bailey (1920) to analyze the factors concerned in the inheritance of egg color. They made crosses between the Black Langshan, a brown-egg race, and Brown Leghorns and Golden Penciled Hamburghs, white-egg races. The progeny of these crosses in the first generation laid eggs which were intermediate in color. The progeny of the second generation gave results which led to the following conclusions: That the color of the brown egg is due to several factors, of which one, the major factor, produces a greater effect than the others.*

INHERITANCE OF EGG PRODUCTION

Research at Cornell University.—For the past twenty years, some very interesting research work has been carried on at Cornell University

TABLE 23

Percentage Production by Four-Week Periods of High and Low Line Pullets at Cornell University Agricultural Experiment Station

(35 Birds in Each Pen Each Year)

Period	High Line Pullets			Low Line Pullets		
	1927–1928	1928–1929	5-Year Average 1924–1929	1927–1928	1928–1929	5-Year Average 1924–1929
Oct. 16–Nov. 2	29.1	62.4	35.4	0.1	3.1	3.4
Nov. 3–Dec. 10	45.9	60.0	43.6	4.1	7.9	9.1
Dec. 11–Jan. 7	64.0	55.7	42.7	25.9	19.5	20.6
Jan. 8–Feb. 4	59.0	50.1	45.2	40.9	32.0	29.4
Feb. 5–Mar. 4	59.1	63.9	59.1	55.2	19.4	40.2
Mar. 5–Apr. 1	67.3	74.9	65.7	60.2	47.4	50.5
Apr. 2–Apr. 29	71.1	73.9	67.7	66.1	60.3	56.3
Apr. 30–May 27	75.4	72.6	69.8	56.8	58.4	54.3
May 28–June 24	74.3	74.4	66.7	53.8	63.7	58.9
June 25–July 22	71.4	73.9	65.9	57.8	62.6	53.0
July 23–Aug. 19	60.6	67.2	59.1	47.9	52.6	44.4
Aug. 20–Sept. 16	42.5	60.8	51.2	18.7	14.9	19.3
Sept. 17–Oct. 15	34.4	47.3	38.2	2.5	8.1	6.5
Per cent production—Year....	60.0	66.6	55.5	37.4	32.7	33.3
Average number of eggs for year.	219.0	243.1	202.5	136.5	120.0	121.5

The males which sired the Low Line Pullets were birds whose dams laid less than 100 eggs in the first laying year. These males were mated to Low Line Hens.

The High Line Pullets came from males whose dams laid 200 or more eggs in the first laying year, and these males were mated to females which laid 170 or more eggs in the first year. The per cent production was computed for all pens on a hen-day basis.

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* In order to determine the number and nature of the minor factors concerned much more experimental work is necessary. It is not claimed by Punnett and Bailey that their views as to the genetic factors concerned with egg color possess more than a suggestive value. A great deal of experimental research could well be carried out on the inheritance of size, shape and color of eggs, which would result in information of great value to the poultry breeder.

on the inheritance of egg production, with particular emphasis upon number of eggs produced. This breeding project was started by Dr. O. B. Kent, and is still in progress. No definite attempt has been made to analyze the factors responsible for fecundity, but some data have been secured which are in very close accord with the work of Goodale, Hurst and others.

This work divides itself into two lines of breeding: first, the low line birds which have been constantly selected for low egg production; and second, the high line birds which have been selected for high fecundity.

Table 23 shows the percentage production by four-week periods of two pens each of low line and high line pullets, the records being made on the experimental farm at Cornell University. The first two columns at the left of the table show the percentage production of the high line pullets for 1927–1928 and 1928–1929. The third column shows the average for five years, 1924 to 1929. Columns four and five show the percentage production for the same periods of two groups of low line pullets, and column six shows the average for five years. The original number of birds in each group each year was thirty-five, and all records were calculated on a hen-day basis. The different groups of birds were kept under similar environmental conditions and were fed and managed in exactly the same manner.

An examination of columns three and six of Table 23 shows that there is a very distinct difference in the production of the two groups of birds. It was found that the low line pullets start laying late; have a low winter egg production; never reach a very high rate of production; and their persistency as indicated by late fall laying is low as compared with the high line groups. The percentage production for the five-year period is only 33.3 in case of the low line birds, while that of the high line birds is 55.5 per cent. The average production for the five-year period is 120.0 eggs and 202.5 respectively, or a difference of 82.5 eggs.

This wide variation exists not only between these two groups of birds in the pullet year, but it is even more marked in the second or later laying years. A part of this difference can be accounted for due to the fact that only the highest of the high line hens are kept and only the lowest of the low lines are retained. Table 24 shows the percentage production by four-week periods of three groups of hens, calculated in the same manner as for the pullets. The first two groups, or pens 13 and 6, are of similar breeding, but are divided according to the production for the first year, pen 13 being hens that laid 200 eggs or more during the first year, pen 6, birds that laid 170 to 200 eggs, and pen 15 is of low line breeding. Very few of the low line hens laid more than 110 eggs during the first year. All of these pens had in them birds of mixed ages, ranging from yearling hens to birds four years of age. All pens were housed, fed and managed in the same manner. Some of the hens in the pens during the year 1924–1925 remained in the same pens the following year, and other birds were added.

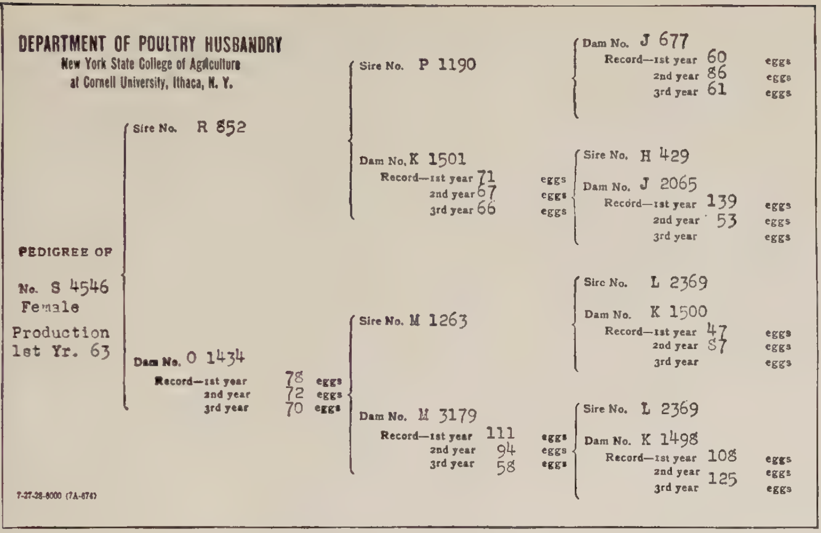
TABLE 24

Percentage Production by Four-Week Periods of Two Pens Each of Low Line Hens, Two Pens of Medium Producing Hens and Two Pens of High Producing Hens Bred at Cornell University Experiment Station, 1924–25 and 1925–26[1]

	High Producing Hens			Medium Producing Hens			Low Producing Hens		
	Pen 13	Pen 13	Pen 13	Pen 6	Pen 6	Pen 6	Pen 15	Pen 15	Pen 15
	1924–25	1925–26	Average for Two Years	1924–25	1925–26	Average for Two Years	1924–25	1925–26	Average for Two Years
Oct. 16–Nov. 12...	11.5	11.6	11.6	8.3	3.3	5.8	0.2	0.5	0.3
Nov. 13–Dec. 10...	2.6	6.1	4.4	3.1	1.0	2.1	1.8	0.0	0.9
Dec. 11–Jan. 7...	3.4	23.3	13.4	3.9	4.3	4.1	1.0	0.0	0.5
Jan. 8–Feb. 4...	16.6	33.3	25.0	21.5	4.3	13.4	2.7	0.0	1.4
Feb. 5–Mar. 4...	37.5	41.2	39.4	39.5	45.3	42.4	34.8	33.4	34.1
Mar. 5–Apr. 1...	42.5	64.0	53.3	47.3	60.8	54.1	43.2	52.1	47.7
Apr. 2–Apr. 29...	59.2	67.1	63.2	49.1	65.0	57.1	55.1	50.4	52.8
Apr. 30–May 27...	69.1	74.1	71.6	56.7	70.3	63.5	52.2	48.2	50.1
May 28–June 24...	66.7	67.0	66.9	55.0	64.6	59.8	38.7	34.6	36.7
June 25–July 22...	69.2	65.3	67.3	52.6	69.8	61.2	27.7	38.7	33.2
July 23–Aug. 19...	59.1	65.5	62.3	45.1	61.5	53.3	18.1	30.7	24.4
Aug. 20–Sept. 16...	46.9	48.6	47.8	27.8	44.2	36.0	7.9	17.2	12.6
Sept. 17–Oct. 14...	25.8	24.6	25.2	13.5	22.2	17.9	1.9	8.3	5.1
Per cent production for year.........	39.2	44.9	42.1	31.7	37.8	34.8	21.9	22.8	22.4
Average number of eggs for year.....	143.08	163.88	153.60	115.70	137.97	127.02	79.93	83.22	81.76

[1] These pens all consisted of hens of mixed ages ranging from yearling to three-year old birds. The low line pens were selected from low line pullets, and no bird was placed in the pen that had laid more than 125 eggs during the first year. The medium producers were birds which had laid 170 to 200 eggs in the first year, and the high producers were hens that had laid 200 eggs or more in the first laying year. The medium and high producers were birds selected from high line pullets on the College Experimental Farm. The percentage production was computed for all pens on a hen-day basis.

By an examination of Table 24 it can be seen that there is wide variation in the number and season of the year in which the eggs were produced by the three groups of birds. Columns three, six and nine give the average percentage production for two years. The fall and winter production for the low line hens was extremely low, even to the



DEPARTMENT OF POULTRY HUSBANDRY
New York State College of Agriculture
at Cornell University, Ithaca, N. Y.

PEDIGREE OF
No. S 4546
Female
Production
1st Yr. 63

Sire No. R 852

Sire No. P 1190

Dam No. J 677
Record—1st year 60 eggs
2nd year 86 eggs
3rd year 61 eggs

Dam No. K 1501
Record—1st year 71 eggs
2nd year 67 eggs
3rd year 66 eggs

Sire No. H 429

Dam No. J 2065
Record—1st year 139 eggs
2nd year 53 eggs
3rd year eggs

Dam No. O 1434
Record—1st year 78 eggs
2nd year 72 eggs
3rd year 70 eggs

Sire No. M 1263

Sire No. L 2369

Dam No. K 1500
Record—1st year 47 eggs
2nd year 87 eggs
3rd year eggs

Dam No. M 3179
Record—1st year 111 eggs
2nd year 94 eggs
3rd year 58 eggs

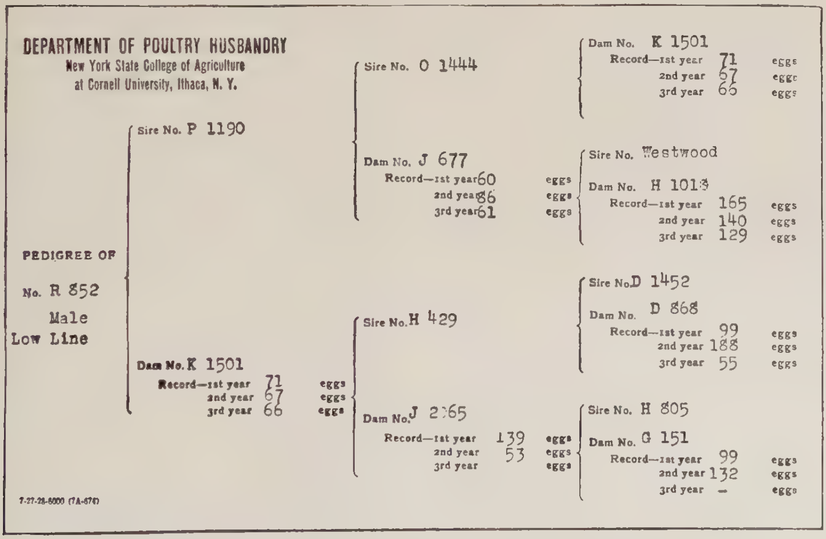
Sire No. L 2369

Dam No. K 1498
Record—1st year 108 eggs
2nd year 125 eggs
3rd year eggs

7-27-28-6000 (7A-674)

Fig. 104.—Pedigree of a Low Line Hen.

Observe the consistency of the three years of production of the dam of S 4546.



DEPARTMENT OF POULTRY HUSBANDRY
New York State College of Agriculture
at Cornell University, Ithaca, N. Y.

PEDIGREE OF
No. R 852
Male
Low Line

Sire No. P 1190

Sire No. O 1444

Dam No. K 1501
Record—1st year 71 eggs
2nd year 67 eggs
3rd year 66 eggs

Dam No. J 677
Record—1st year 60 eggs
2nd year 86 eggs
3rd year 61 eggs

Sire No. Westwood

Dam No. H 1013
Record—1st year 165 eggs
2nd year 140 eggs
3rd year 129 eggs

Dam No. K 1501
Record—1st year 71 eggs
2nd year 67 eggs
3rd year 66 eggs

Sire No. H 429

Sire No. D 1452

Dam No. D 868
Record—1st year 99 eggs
2nd year 188 eggs
3rd year 55 eggs

Dam No. J 2065
Record—1st year 139 eggs
2nd year 53 eggs
3rd year eggs

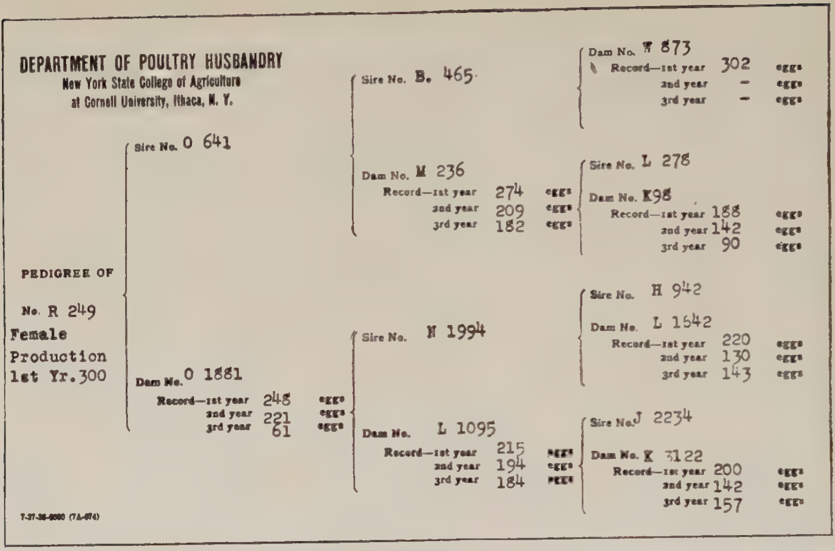
Sire No. H 805

Dam No. G 151
Record—1st year 99 eggs
2nd year 132 eggs
3rd year — eggs

7-27-28-6000 (7A-674)

Fig. 105.—Pedigree of a Low Line Male No. R852.

This is the immediate sire of the low line hen shown in Fig. 128.



DEPARTMENT OF POULTRY HUSBANDRY
New York State College of Agriculture
at Cornell University, Ithaca, N. Y.

PEDIGREE OF
No. R 249
Female
Production
1st Yr. 300

Sire No. O 641

Dam No. O 1881
Record—1st year 248 eggs
2nd year 221 eggs
3rd year 61 eggs

Sire No. B. 465

Dam No. M 236
Record—1st year 274 eggs
2nd year 209 eggs
3rd year 182 eggs

Sire No. N 1994

Dam No. L 1095
Record—1st year 215 eggs
2nd year 194 eggs
3rd year 184 eggs

Dam No. Y 873
Record—1st year 302 eggs
2nd year – eggs
3rd year – eggs

Sire No. L 278

Dam No. K98
Record—1st year 188 eggs
2nd year 142 eggs
3rd year 90 eggs

Sire No. H 942

Dam No. L 1642
Record—1st year 220 eggs
2nd year 130 eggs
3rd year 143 eggs

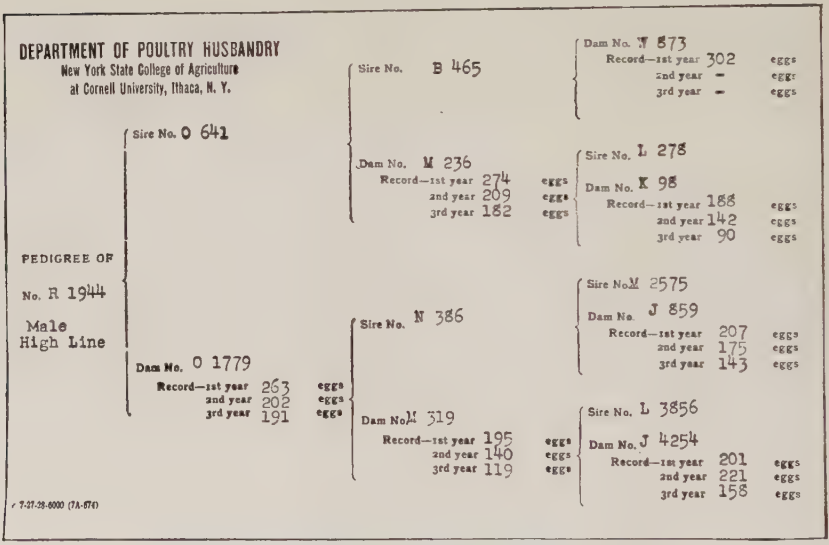
Sire No. J 2234

Dam No. K 3122
Record—1st year 200 eggs
2nd year 142 eggs
3rd year 157 eggs

7-27-28-6000 (7A-674)

FIG. 106.—Pedigree of Hen No. R249, a High Line Hen Laying 300 Eggs in Her First Laying Year.

Her pedigree shows that it was bred in her.



DEPARTMENT OF POULTRY HUSBANDRY
New York State College of Agriculture
at Cornell University, Ithaca, N. Y.

PEDIGREE OF
No. R 1944
Male
High Line

Sire No. O 641

Dam No. O 1779
Record—1st year 263 eggs
2nd year 202 eggs
3rd year 191 eggs

Sire No. B 465

Dam No. M 236
Record—1st year 274 eggs
2nd year 209 eggs
3rd year 182 eggs

Sire No. N 386

Dam No. M 319
Record—1st year 195 eggs
2nd year 140 eggs
3rd year 119 eggs

Dam No. Y 873
Record—1st year 302 eggs
2nd year – eggs
3rd year – eggs

Sire No. L 278

Dam No. K 98
Record—1st year 188 eggs
2nd year 142 eggs
3rd year 90 eggs

Sire No. M 2575

Dam No. J 859
Record—1st year 207 eggs
2nd year 175 eggs
3rd year 143 eggs

Sire No. L 3856

Dam No. J 4254
Record—1st year 201 eggs
2nd year 221 eggs
3rd year 158 eggs

7-27-28-6000 (7A-674)

FIG. 107.—Pedigree of a High Line Male R1944.

His immediate dam had a splendid record but her ancestors were much lower.

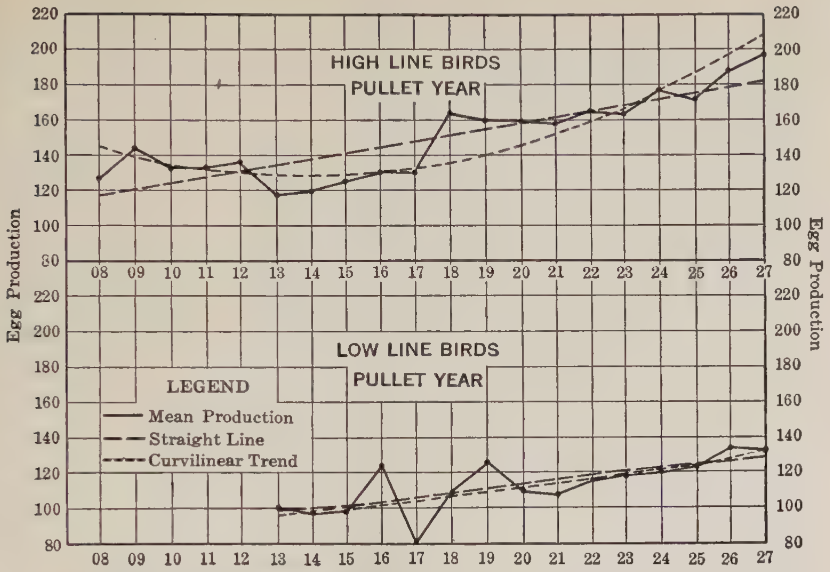


FIG. 108.—Changes in First Year Egg Production of High and Low Line Birds.

At the time the two lines were segregated the difference between them was 19 eggs. Fifteen years later the difference was 64.2 eggs.

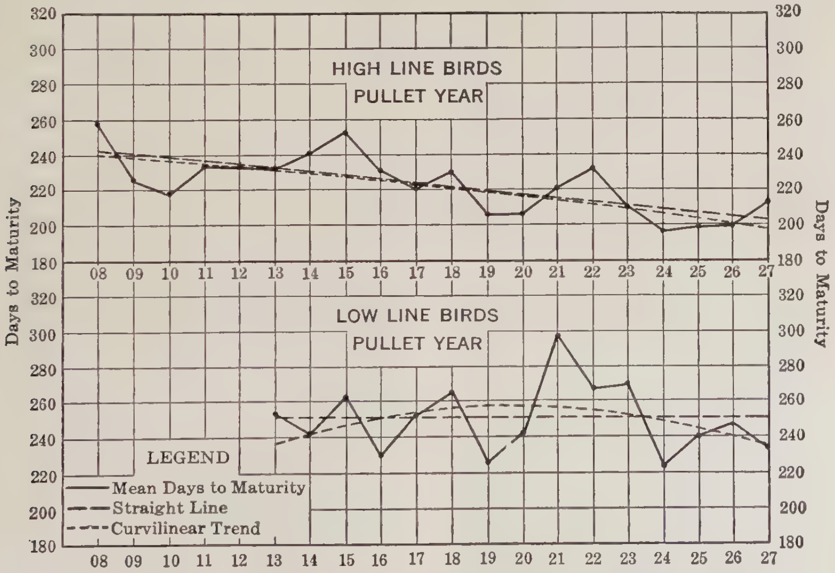


FIG. 109.—Changes Which Have Taken Place in Number of Days to Maturity (Age at First Egg) of High and Low Line Birds.

The trend has been distinctly downward in the high line birds. Little change has taken place in the low line birds.

point that during three complete periods in 1925–1926 no eggs at all were produced. The percentage production for the year in case of the low line birds was only slightly over half as much as for the highest producers of the high line birds, the production of the medium producers falling between the two In other words, the low line hens laid only about half the number of eggs produced by the best of the high line hens, and the eggs which were laid by the low birds were produced, for the most part, in the spring and early summer months when the price of eggs is lowest.

Since these birds are kept under identical conditions of housing, feeding and management and are

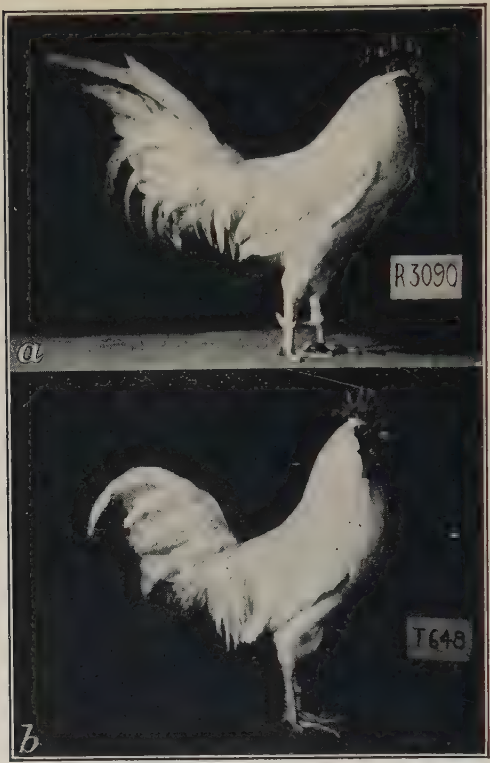
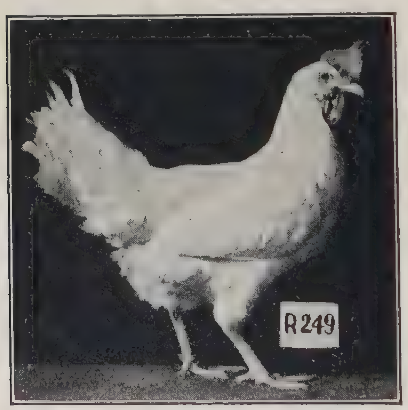


Fig. 110.—Compare the High Line Male (*a*) with the Low Line Male (*b*).

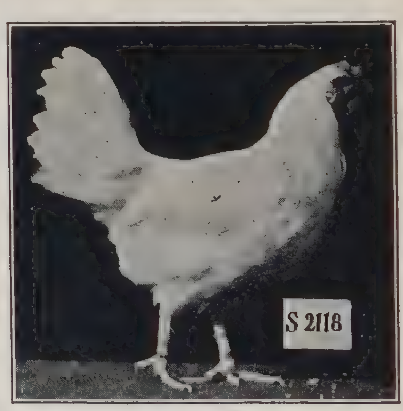
(*a*) is cock R3090 and his dam laid 302 eggs in her first laying year. The dam of (*b*), a cockerel T648, was a 96 egg hen.



Courtesy Cornell University.

Fig. 111.—Hen R249, a High Line Bird.

Her production for the first year was 300 eggs.



Courtesy Cornell University.

Fig. 112.—Hen S2118, a Low Line Bird.

Her production for the first year was 72 eggs. The bird has a good body but lacked the inheritance necessary for production.

selected carefully for vitality, there must be some reason other than environment for the differences in egg production shown in these records.

These differences can be accounted for, in part at least, by contrasts in the genetic constitution, or factors which they have received from their ancestors which are responsible for fecundity or egg production. Figs. 104 and 105 show typical pedigrees of a male and female of the low line birds. These birds have been bred for low egg production for many generations. Figs. 106 and 107 show the pedigrees of two high line birds, a male and female, which indicate what the ancestry of the high line birds has been for several generations. Where the ancestry of these two groups of birds is traced back fifteen generations it will be found that both groups had a common ancestry. If individual records are studied it will be found that there is a great deal of variation in both groups of birds. This is to be expected, due to the complex nature of the inheritance of egg production. The average or mean production for the two groups, however, is very different as shown in Tables 23 and 24, and Fig. 108 which shows trends over a twenty-year period.

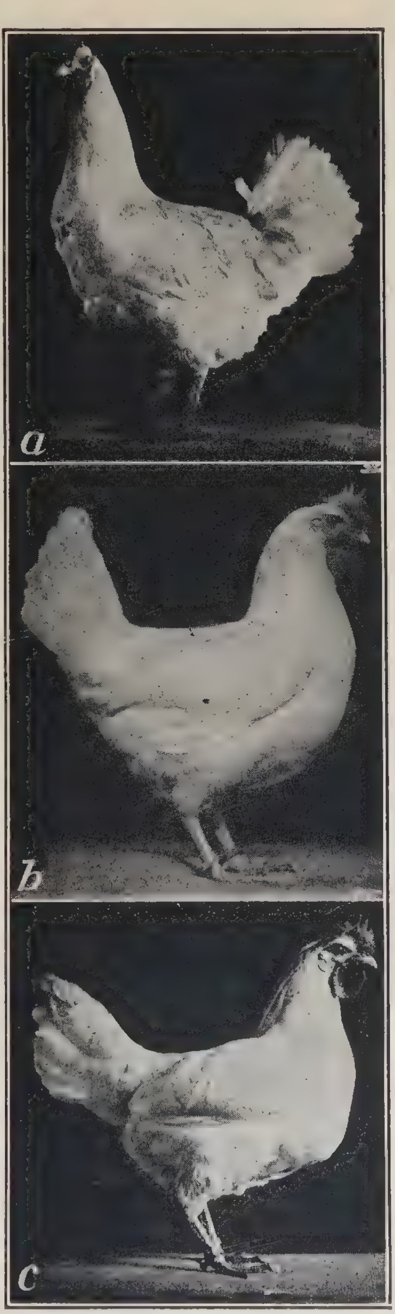


FIG. 113.—James Dryden's Famous Three Generations of McDuffs.

a. Grandmother, 201 eggs 1st year.
b. Daughter, 303 eggs 1st year; 209 eggs 2nd year; 167 eggs 3rd year; 202 eggs 4th year; 881 eggs in 4 years.
c. Granddaughter, 254 eggs 1st year. 10 sisters averaged 250 eggs per bird.

The records of the low line birds would indicate that many individuals in the group lack one, two, three, or even four of the factors; maturity, high rate, persistency, winter pause, and broodiness as reported by Goodale for high-egg production. This is indicated by the fact that a great many of the low line birds do not begin laying until late in the fall; that they never reach a very high rate; that the winter production is low; and that they cease laying early in the fall, or do not possess the persistency factor. The hens appear to show the absence of these factors more than pullets since the highest birds are removed from the pens. Fig. 109 shows the changes which have taken place in the days to maturity in the two lines of breeding.

Courtesy Hollywood Poultry Farm.

FIG. 114.—A "Masterpiece" and His Master.

A seven-year-old Leghorn male; the combined results of many generations of high producers, and M. E. Atkinson, a master breeder who has kept constantly in mind size, vitality, and longevity.

This is cock "Red 16" sire of hen 779 Storrs Contest, 1926–27—record of 318 eggs and hen 376, Western Washington Contest—record of 325 eggs. "Red 16" is from No. 448, best hen at Ottawa Contest 1922–23 with a record of 300 eggs. M. E. Atkinson says, "I believe that this is the best producing male we have ever owned. He was active and a good breeder and producer of top stuff for five seasons."

Although the high line birds do not in all cases appear to possess all the factors for high egg production, apparently they do possess some of them in pure form. The progeny produce much better records than the progeny of the low line birds.

Of all the assumed factors concerned with egg production, in the low line birds, sexual maturity seems to be the one which is most frequently lacking. Very few of the pullets begin laying early after they have been removed from the range and placed in the laying houses. On the other hand many of the high line pullets of the same age are laying for several days or even weeks before they are placed in winter quarters. (Fig. 109 and Table 23.) On the average the low line birds begin laying about 30 to 40 days later than the high line birds. (Fig. 109.) Since the chicks are hatched from both lines of birds in the same hatches the average hatching date does not vary to any extent. Figs 110, 111 and 112 show several high and low line birds.

In comparing the two groups of birds it will be seen that the rate of production reached by the low line birds is seldom as high as that of the high line, and for the major portion of the year there is a marked spread between the two. It will be noted also that the low line birds lay only in the spring of the year when egg prices are low, which has an economic importance when the item of net income is considered. Eggs produced in times of high prices may be several times as valuable when the actual net income is considered as compared with eggs produced in seasons of low prices.

The question often arises whether the male or the female has the greater influence upon egg production. It appears to be perfectly clear that both male and female play essentially an equal part in determining the egg production of their daughters. Whether one is more important than the other depends upon the particular individuals that are mated. In breeding for high egg production the influence of either male or female must be judged by their prepotency; that is, by the production of the offspring. (Figs. 113 and 114.)

PART TWO

PRACTICE OF CULLING AND SELECTION

CHAPTER XII

CULLING THE FARM FLOCK

Culling is Profitable.—Culling out the non-producers is one of the most effective ways of increasing the profits of a poultry flock. This reduces feed costs by eliminating birds that have ceased to lay. In addition to this it gives the remaining birds in the flock a better opportunity by allowing more room. It also places the culls on the market before the season of lowest prices. The largest proportion of the live poultry is marketed during the late summer and early fall months and as a result the price is forced down very low at this season of the year. Table 25 shows the seasonal variations in the receipts and prices of live poultry.

TABLE 25

Comparison by Months of Price of Leghorn Fowls and Total Receipts of Live Poultry in New York City. Four-Year Average 1926–1929.

Month	Average Price of Leghorn Fowls in New York City, Cents	Total Receipts of Live Poultry in New York City, Carloads
January	30.0	897
February	30.1	865
March	30.9	1,053
April	31.7	958
May	31.2	937
June	26.2	930
July	25.7	931
August	24.3	1,047
September	23.6	1,111
October	22.1	1,175
November	22.6	1,169
December	24.2	1,112
Average	26.8	1,013

Culling is Becoming a Universal Practice.—In many sections of the country two different systems of culling are being practiced. Under one system the entire flock is caught once or twice each year and the unprofitable birds are removed. This plan has been developed in many states to the point where trained specialists are sent out by the state colleges to the various counties, for culling work. These men go from one farm to another under the direction of the local County Agent. The County Farm Bureau usually hires the specialist by the week and pays him from a fund built up from a per bird charge made for each bird handled by the specialist. Occasionally the culler makes a direct charge to the poultryman and whatever he collects is his salary. The charge varies from one to two cents per bird handled. In New York State approximately 250,000 birds are handled annually by these trained specialists.

The second system used is where the poultryman does his own culling at such times during the year as he feels the necessity exists. This plan is very desirable for the man who has a flock large enough to make it worth while for him to acquire the necessary training. It is the next step following paid culling.

TIME TO CULL

Culling of poultry of all ages, to a limited extent, should be a continuous process because diseased, crippled or otherwise defective birds should be removed from the flock as they are detected. Where only one culling is made during the year it is preferable that this culling should be done sometime during the latter part of August or early September, in the north temperate zone for April and May hatched chicks, and correspondingly earlier for southern latitudes. Where two cullings are made, the first one should be made in late July or early August in order to take out the early molters, and the second one during September or October. This second culling is really for the double purpose of culling for market and making final selection of the layers and breeders that are to be kept over the winter for another year. Two cullings are much better than one because it gives an opportunity for removing the early molters soon after they have ceased production. Likewise monthly or bi-monthly cullings are preferable to only two cullings. In order to make culling most effective, one should start in June or July and cull at least every month until October 15 or November 1. Fig. 115 shows the rate at which a flock of Leghorns went out of production. Straight culling or the removal of those hens that have ceased production is really the poultryman's job, because only under such conditions is it feasible for it to be done more than twice during the year. The final selection of layers or breeders or the pullets and cockerels to be kept over for production or breeding, in most instances, can be done more efficiently by the specialist than by the poultryman. More and more, however, the poultrymen are learning to cull efficiently for themselves. This is as it should be except where official records and guarantee of quality are desired.

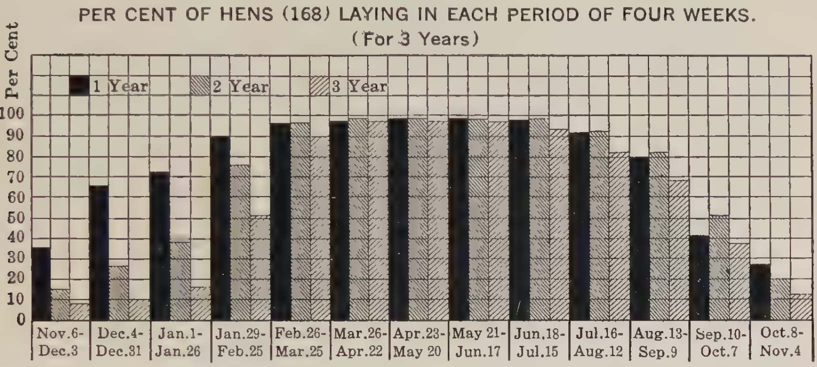


Fig. 115.—The Rate at Which a Flock of Leghorns Went Out of Production during a Three Year Period.

PROCEDURES IN CULLING

Catching the Birds.—The poultry flock if it could be caught as easily as a cow or horse would be culled more often than it is now. A flock can be caught up with the least disturbance by the use of catching crates. Time and material spent in the building of catching crates are paid for many times during the year.

How to Build a Catching Crate.—A good catching crate should be large enough to hold twenty-five to thirty birds without crowding; light enough in weight so that it may be moved easily even when full of fowls; arranged with sliding doors on each end and on top; with hard wood runners to facilitate moving; holes for handles at each end; narrow enough to allow passage through doorways when loaded; and finally it should allow free circulation of air through the crate to prevent smothering.

The end doors should be so arranged that they can be raised or lowered easily. This enables one to set two or three crates end to end and thereby give space for eighty or one hundred birds at a time. The door in the top should slide freely. Birds will not escape through a sliding door nearly as readily as through a hinged door which has to be lifted open in order to take out a bird. Fig. 116 shows a desirable type of catching crate.

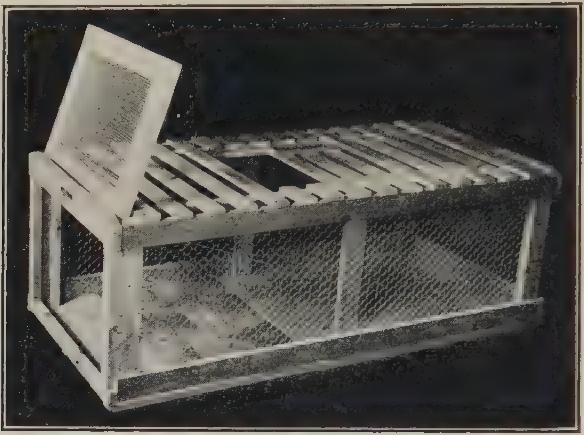


FIG. 116.—Desirable Type of Catching Crate.

Note sliding door in top, and runner on the bottom to facilitate moving.

How to Use a Catching Crate.—The crate can be set in a doorway between the pens and the remainder of the opening above the crate covered. Many poultrymen set the crate outside of an outdoor exit

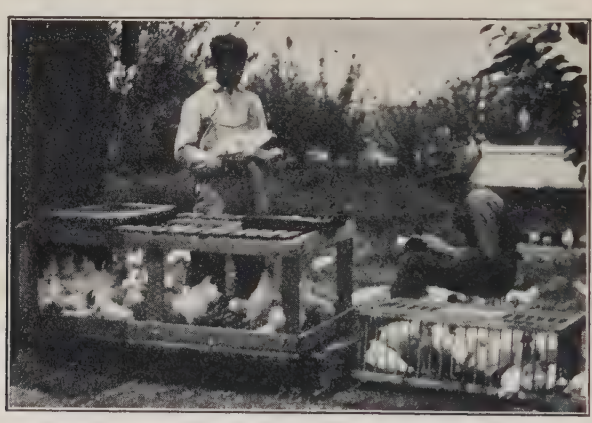


FIG. 117.—The Catching Crate in Use at the Exit Door of a House.

and drive the birds through the exit door into the crate. The exit door should be near a corner of the pen, or difficulty will be experienced in driving the birds through the door. It is also important that this door shall be one that the birds are accustomed to using. Fig. 117

shows a catching crate with the open end located at the exit door ready for work. Figs. 118 and 119 illustrate other important ways of making use of catching crates.

The Portable Wire Enclosure Method of Catching.—Where a catching crate is not available it is usually possible to pen off a portion of the house with a section of wire fence about fifteen feet long so that a few hens may be confined in close enough quarters to allow catching without chasing. The most popular method is to take a strip of closely woven (about 2-inch mesh) 5-foot poultry fence and nail or hook one end to the side wall about five or six feet from a corner. To the bottom of the fence there should be nailed several short strips of wood thus holding the fence close to the floor and preventing the birds from crawling beneath. The wood is not necessary if very heavy wire is used. Pieces of two by fours or one by threes serve very well for this purpose.

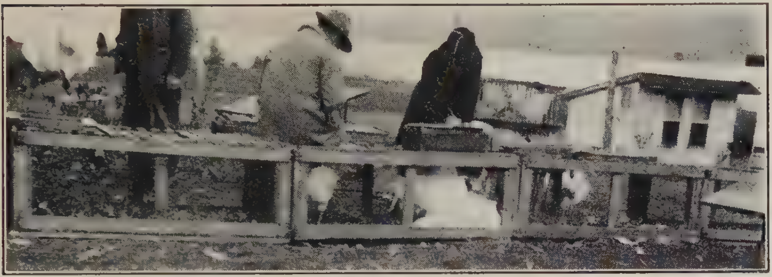


Fig. 118.—Separate Unit Catching Crates Arranged End to End for Quick Handling of Birds in Selection.

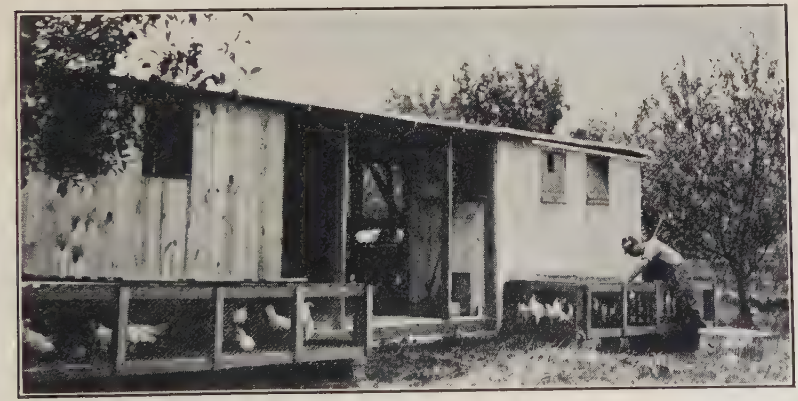


Fig. 119.—A Portable, Multiple Unit, Sanitary Grading Crate for Rapid Handling of Stock.

The other end of the fence is left free. Where a small group of birds is driven into the enclosure, the fence is pulled around them and fastened to the wall. One person inside the enclosure catches the birds and hands them to the culler. Less frightening of the birds occurs when this method is used as compared to hooking up the birds at large in the pen. Fig. 120 illustrates how this plan is actually worked out.

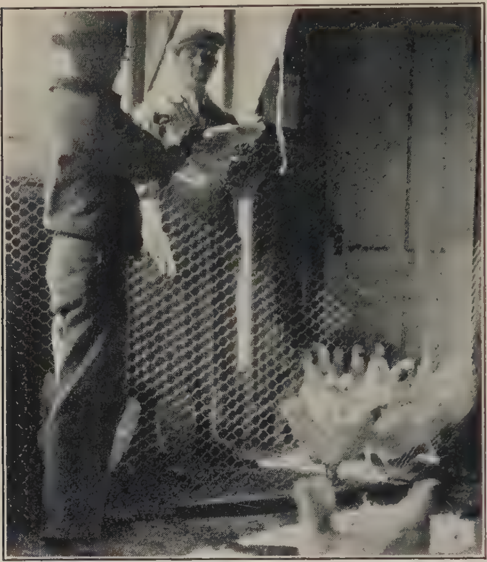


Fig. 120.—Wire Used for Catching up Birds in the Laying House.

This takes the place of a catching crate on many farms.

Sometimes the fence is stretched along the front of the roosting platform for a few feet and the birds caught after having been driven into this pen. It is more difficult, however, since the man doing the catching must be in a cramped position.

This method also is objectionable because of the danger of the birds piling up in a corner and smothering.

The Catching Hook and Landing Net Method of Catching.—Another method used in daylight catching is the catching of each bird from the floor of the regular laying pen by means of a catching hook or catching net. As shown by Fig. 121, these tools are simple, handy devices

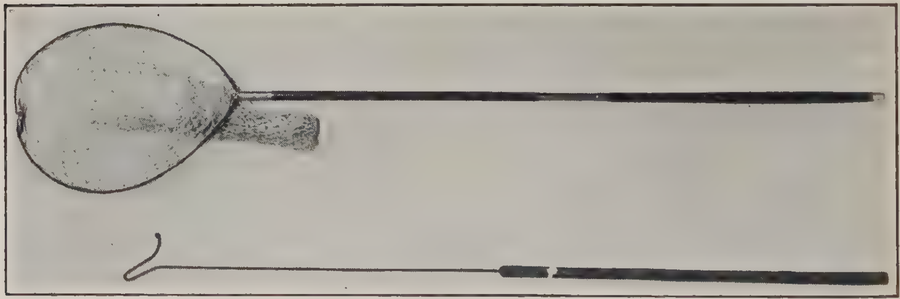


Fig. 121.—Catching Hook and Landing Net.

when but a few birds are to be caught but involve some danger of injury to the birds when they are used by an inexperienced person. A great amount of chasing is necessary before a large flock is caught in this manner and the gripping of the leg when caught by the hook is liable to injure the bird. A net is not suitable for inside work where many projecting nails or boards are present because it may become caught and torn. The net is especially desirable for catching certain individuals when they are in a large pen or yard, because the danger of escape when once caught is less. The net should be so handled as to allow the birds to run into it.

Night Culling by Flashlight.—Many poultrymen follow the practice of culling at night by the use of a flashlight while the birds are on the perches. This method saves time and avoids fright. Very little disturbance is caused among the birds when this method is used. All birds removed at night should be re-examined the following morning to see that no mistakes have been made. It is easier to see the birds on the back rows if the perches are especially arranged for night culling.

On farms where a large proportion of the hens are to be removed and a large number of shipping crates are available, it may be advisable to remove all of the birds from the perches at night and place them in the crates. If this is done the birds should be handled very early the following morning. The crates should have an abundance of clean straw or shavings on the bottom to keep the birds clean and comfortable. This method saves some time and if the birds are not crowded causes very little disturbance.

How to Remove and Hold the Birds.—There is one right way and there are several wrong ways of removing a bird from the catching crate and holding her for inspection. Practically all experienced judges hold their birds in about the same manner.

When removing from the catching crate one or both wings may be grasped close to the body and the bird lifted quickly from the crate. When removed in this manner there is less possibility of fluttering and the bird getting away. If the bird is grasped by one or both legs and pulled out feet first the wings spread out and are liable to catch on the crate. A bird is more subdued and helpless without the use of the wings than it is without the use of the legs.

In holding a bird for examination rest the breast of the bird, or keel bone, upon the palm of the hand (the hand used will depend upon whether the culler is right or left handed) with the head of the bird pointing toward the person handling it. The legs are grasped at the hock joints by the fingers of the hand in which the bird is being held. Always keep at least one finger between the thighs of the bird in order to prevent squeezing the abdomen. It is convenient for most persons to place the index finger between the thighs, holding the legs of the bird firm with the thumb and the finger next to the index finger. The part of the hand between the thumb and first finger may be used as a support to the bird in order to prevent it from tipping sideways. The bird is most comfortable when held in this position and unless she is badly frightened is not likely to flutter. This leaves one free hand with which to spread out the wings or turn the head in order to examine the bird. (Fig. 176.)

Examining the Bird.—The culler should handle each bird, noting all the points that may be used in culling before making a decision. It is seldom safe to use one character alone in deciding whether to discard the bird or hold her for a longer period. One character may not always indicate the true condition and value of a bird. When it is difficult to decide whether a bird should be culled or retained it is usually well to give the bird the benefit of the doubt and keep her. It is better that some of the poor birds be kept than that some of the more desirable ones be thrown out. It may take but a few seconds to make this decision because the characters indicating a good or poor bird will be very outstanding while in marginal birds a longer time may be required to render an accurate decision.

PRECAUTIONS ABOUT CULLING

Always ascertain the management of a flock before culling. The best of hens may be out of condition and production if the environmental conditions are not suitable. A complete discussion of how these environmental and management factors may affect production is given in Chapter X.

All birds that are out of production or very light in weight or show indications of sickness should be removed. Birds that are very thin cannot continue with profitable production and hence they should be discarded. Diseased fowls are a menace to the other birds of the flock and also are usually too rundown physically to be profitable as layers or for fattening. The best way to reduce mortality is to cull rigidly and continuously. This practice saves feed and helps to prevent the spread of disease.

The best plan to follow with regard to broody birds will depend upon the time of year, the breed and the length of time that the bird has been broody. If Leghorns are being culled the broody birds probably should be removed and sold, whereas in the heavy breeds, if otherwise desirable, they might be retained. If the culling is being done very early in the summer probably it would pay to retain the bird because she should soon come back into production if managed properly. If it is late in the fall the bird should in most instances be culled rather than to attempt to bring her back into production under unfavorable conditions. Some birds become broody frequently but such birds can usually be detected. They should be culled. A convenient method to use in detecting persistently broody hens is to band with spiral, celluloid bands all birds when placed in the broody coop. If this is done the extent of the broody tendency is quickly apparent by the number of bands.

DISTINGUISHING A LAYING HEN FROM ONE NOT LAYING

The first step in culling is to determine whether a hen is laying or not. This fact is indicated in many ways.

(1) *The Comb and Wattles.*—The comb and wattles of a laying bird generally should be red and waxy, especially if the bird has been in production only a short time. If the comb is shriveled down and especially if it is hard, dry and covered with loose, grayish scales, one can be fairly sure that the bird has ceased to lay. (Fig. 122.)

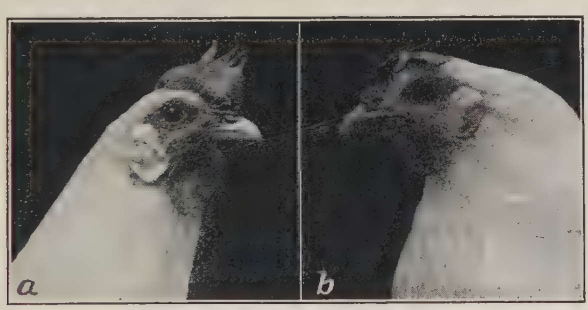


FIG. 122.—The Heads of Birds in Laying and Dormant Condition.

The bird on the right was laying heavily at the time the photograph was taken while the bird on the left had not laid for several weeks.

(2) *The Face.*—The face of a laying hen will be free from excess fat and generally will be bright red in color. The fat is withdrawn slowly from the body as the bird continues in production and hence the bird that is just beginning to lay may still have a fatty appearance in the face. A bird that has laid intensively, especially undersized birds, may have pale faces. A hen not laying that has been out of production for some time will have a very marked tendency toward a fatty face, especially in the heavier breeds. The face will also show a trace of the yellow pigment due to the layer of fat beneath the outer skin.

(3) *The Eye.*—The laying bird will more frequently have a bright, sparkling eye than will the hen not laying, although many poor birds have fairly bright eyes when they are in good physical condition. The bird is usually in poorer physical condition just after production ceases than at any other time of the year and hence at this time the usual brightness of the eye is often lacking. Fig. 122 shows some of these conditions.

(4) *The Vent.*—The vent of a bird in dormant condition will usually be contracted, small in size, round in shape, and yellow in color. The yellow color of course will be found on the yellow-skinned breeds only. The amount of color will depend also upon the amount of yellow corn and green feed that the flock is receiving. On the other hand the vent of a hen laying heavily will be dilated, crescent in shape and bluish white in color. Fig. 123 shows the vents of hens in laying and dormant condition.

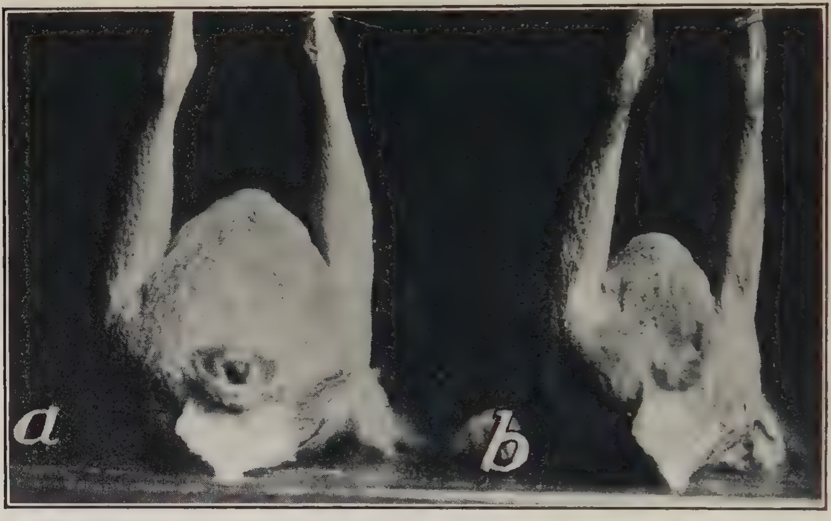


Fig. 123.—Contrast between the Size and Shape of the Vent of a Laying Hen and a Hen in Dormant Condition.

(5) *The Skin.*—The skin over the abdomen of a bird not laying will be tight and rigid with layers of fat underneath, whereas in a laying hen the skin will be soft, loose and pliable. Also the abdomen will be expanded in the laying hen due to the slightly enlarged intestines and the greatly enlarged oviduct. (Fig. 123.) In a bird not laying this expansion is not evident except in rare cases where internal tumors or heavy accumulation of hard body fat are present.

(6) *The Pubic Bones.* — The pubic bones may be close together and the distance between the pubic bones and rear end of the keel bone may be very small in case of the birds out of production. Fig. 124 shows this measurement. These two measurements will depend to a large extent on how long the bird has been out of production. In a laying hen these bones will, as a rule, spread apart and become somewhat flexible on the end, whereas in a bird not laying they are more likely to be close together, stiff, and sharply pointed or else covered with layers of fat, causing them to feel blunt and hard. In an emaciated bird they will be very sharply pointed with no flesh on them as contrasted to the heavy layers of fat as found in the normal, healthy bird, that has been out of production for some time. The pubic bones of the heavy breeds are naturally larger and more blunt than the bones of the Leghorns, this especially being true of the meat varieties.

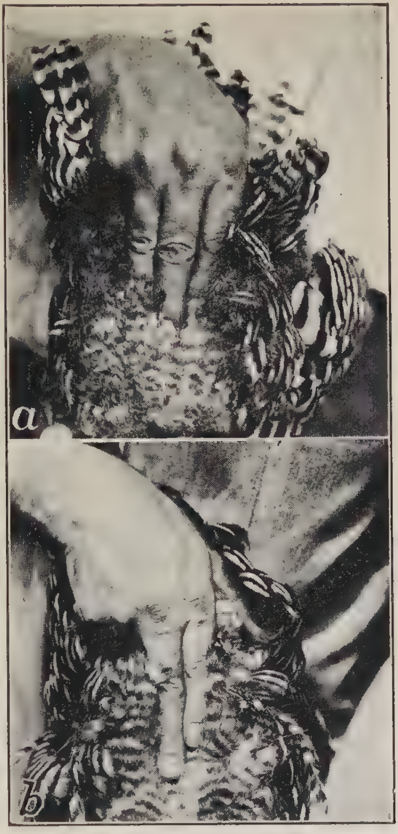


Fig. 124.—(*a*) Shows a Bird with Three Fingers Width between the Pubic Bones. (*b*) Shows a Bird with a Two Finger Span.

WHAT TO DO WITH HENS NOT LAYING

In ordinary culling work the bird with the scaly comb, dry, yellowish colored vent, and tucked-up abdomen should be culled. Birds that in the late summer months have ceased to lay as indicated by these characters will not, as a rule, come back into production again. Occasionally birds that have been mismanaged will, when placed under favorable environmental conditions, come back into production. However, it rarely pays to retain non-laying birds at that time of the year, especially when they are to be sold later in the fall. Any profit made on the eggs laid in the two or three months that they might be kept is lost in the lower meat value obtained when the birds are finally disposed of as cull hens later in the season. The same policy applies equally well to disposing of broody hens when they are slow in coming back into production.

DISTINGUISHING GOOD FROM POOR LAYING QUALITY

Pigmentation.—The characters just outlined indicate whether a bird is laying or not at the particular time the culling work is being done. Only to a small degree will they indicate how long the bird has been in or out of production. Other characters give us a better measure of the length of the production period. Yellow-skinned birds such as the Leghorns, Rocks, Reds and Wyandottes reveal the laying condition by the amount of pigment showing in certain parts of the body. In looking over a flock of birds in the late summer or fall particular notice should be taken of those birds having deep yellow shanks and beaks. During the summer months birds that are deeply colored with yellow pigment in the vent, beak and shanks should be culled, even though the comb may be well expanded and red in color. These birds as a rule are individuals that have broken down in the reproductive region or are taking on male characteristics. A bird of this type is shown in Fig. 143. Note the straight, upright comb and the tendency to a masculine coarseness in the head.

Save those birds that are well bleached out in the beak and shanks and are also in good physical condition. This is a good indication of long, continuous production and sustained vigor. On the other hand do not necessarily cull out a bird merely because she is carrying a small amount of yellow color in her beak and shanks. Some hens have the ability to lay heavily and still maintain a part of this yellow pigment. These may be the best birds because they have greater recuperative power. Such birds will show that they are laying by the enlarged, crescent-shaped condition of the vent; the pliable, yet expanded, abdomen; loose, heavy flesh and generally the red, waxy comb. As soon as the bird ceases to lay, the yellow pigment begins to return and is visible around the vent within a few days. In a period of two to four weeks it will be visible in the beak and shanks. This may be used as an additional indication that the hen has ceased production.

This discussion of pigmentation refers only to culling in late summer and fall months. One must be very careful in applying the yellow pigment test or serious errors will be made. Fowls that have free access to grass range such as alfalfa or clover, or have an abundance of yellow corn in their ration may not fade out as rapidly as birds lacking these conditions. In addition to this some birds have a deeper pigment color to begin with than do other birds, and therefore would require a longer time in which to bleach out that color. A more detailed discussion of this topic is given in Chapter V. Because of having more uniform environmental conditions and these conditions understood, more accurate culling may be done on one's own farm than in a show room or by going from farm to farm.

Molt.—Most birds regardless of their skin color lose their plumage and grow a new coat of feathers annually. During the summer and early fall months cull out the hen that sheds her body, tail and wing feathers. She is an unprofitable bird to keep in the laying flock. Occasionally a good bird will lose a few feathers from time to time, especially on the neck and in the wing, and still continue in production, but birds that molt out their body plumage and tail feathers as well as their wing feathers usually quit laying about the same time or just prior to the time that they began to molt. This matter of production as indicated by the molt can always be checked by means of those characters indicating laying condition. Early molters are unprofitable birds because the time required for the renewal of the plumage is much longer than it is with the late molters. Hence their laying period is cut short. The very early molter may be detected easily if seen when she starts to molt, but in some cases she may have grown in her new feathers sufficiently to escape notice. If one looks closely she may be detected by

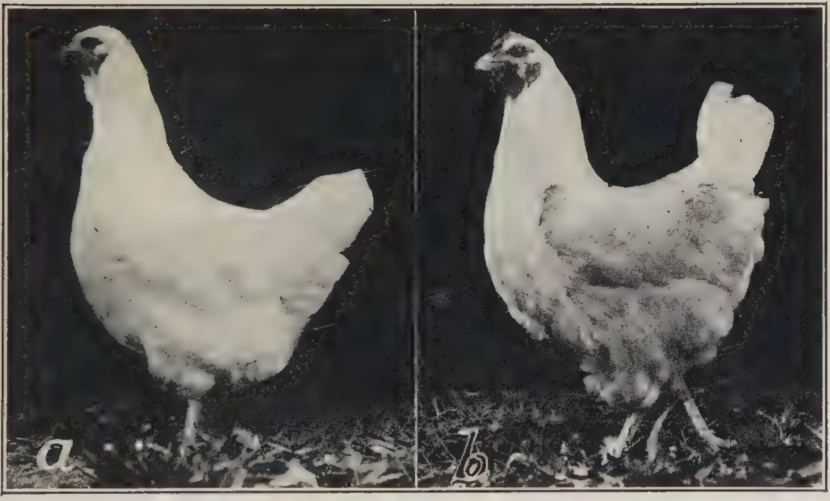


FIG. 125.—(*a*) New Plumage of the Early Molter. (*b*) Ragged, Dirty Plumage of Bird that Has not Molted.

Photographs taken October 30th. Production of bird on right 254 eggs, and bird on left 74 eggs.

her clean, new plumage or the growing pin feathers, while the hen that has not molted will have soiled, ragged or broken plumage. (Fig. 125.)

Poor management such as a radical change of feed or infestation of external or internal parasites will often force good hens to molt their plumage prematurely. If noticed in time and the cause removed these birds can be checked in their molt and brought back into laying. If in late summer or early fall the birds get too much of a start in the job of shedding their feathers it may be advisable to allow them to complete their molt and bring them back into early winter production.

A bird usually can be quickly and easily classified by the molt when she is either a very high or very low producer. The bird that is on the border line may require a close examination before a correct decision can be made. Dividing a flock into culls and layers is one of the easiest parts of culling work because one does not have to observe the fine points required in the selection of commercial layers to be kept over for another year of production or in the selection of the breeders from which next year's chicks will be hatched.

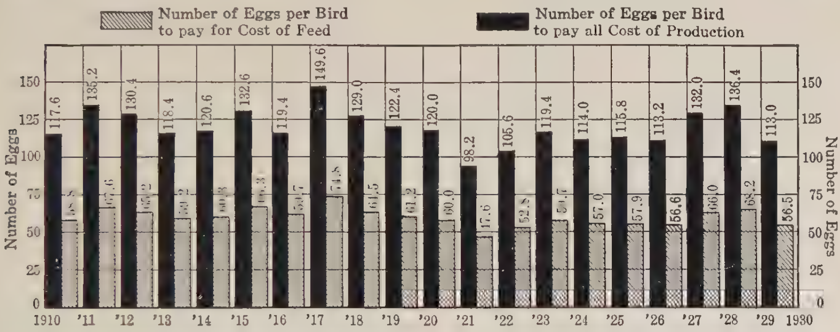
WHICH BIRDS TO SELL AND WHICH TO KEEP

The economic conditions at any particular time must determine how good or how poor a layer may be to be retained for profitable production.

The most important factor in economical egg production is the number of eggs laid per hen per year. As the average price per dozen eggs decreases the average number of eggs per hen must increase proportionately in order to pay the same profit, other factors being even. But other factors of expense are not likely to be even. The cost factors increase or decrease. Feed is the principal cost of egg production—about 50 per cent. There are four combinations of circumstances possible: (1) High-priced eggs and high-priced feed; (2) low-priced eggs and low-priced feed and the margins of the profit are similar; or (3), we may have a prosperous year of high-priced eggs and low-priced feed and this yields the largest profit; or (4) we may meet the unfortunate condition of low-priced eggs and high-priced feed when we can not make a profit and may take a loss, if we do not know how to judge our birds by physical examination so as to change the average egg laying quality of our stock to fit the economic conditions.

When situations (1) or (2) occur it is equally important that we have good laying stock since it requires high quality of stock to pay for high-priced feed, and high quality stock to lay enough low-priced eggs to pay for low-priced feed. Situation (3) with high-priced eggs permits a lower average egg production to pay for the lower-priced feed. One, therefore, does not need to cull so closely in order to pay a profit. To cull rigidly means to keep less hens and make a larger profit per bird. In the case of situation (4) the low-priced eggs and high-priced feed make it imperative that the culling shall be most rigid and only the very best birds shall be kept, since every bird that does not lay enough eggs at a low price to pay for feed at a high price is kept at a loss and must be boarded at the expense of the hens that lay enough eggs to pay a profit. All of this means that no longer can we consider that " hens are hens " as " pigs is pigs." We must make the laying quality of our stock fit the price of eggs and the cost of production.

How these economic factors vary from year to year are strikingly shown in Fig. 126 and Table 26. This deals with the egg feed ratio each year from 1910 to 1929 inclusive for the United States. The egg feed ratio shows how many eggs a hen would be expected to lay in order to pay for the feed as shown by the broken graph and to pay for all costs as shown by the solid graph. The range of annual egg production per hen to pay all costs for the years is for 1917, 149.6 eggs as contrasted with 1921, 98.2, a difference of 51.4 eggs. In other words, in 1917, the costs of egg production were so high in proportion to the price of eggs that it would require a flock averaging more than 150 eggs before any net profit could be realized. Whereas in 1921 when costs were so low proportionately to the price of eggs that all of the eggs laid over 99 would be net profit. From these figures based on averages covering a period of 20 years for 1910 to 1929 it would require a flock laying 122 eggs per year in order to break even. A horizontal line showing the average number of eggs required per hen per year for 20 years would indicate the years when losses would have occurred or net profits have been made if the same quality of stock had been kept.



Prepared by J. C. Huttar, Cornell University

Fig. 126.—The Ratio of the Price of Feed to the Price of Eggs Since 1910.

TABLE 26

THE EGG-FEED RATIO

(J. C. Huttar, Cornell University)

Year	Feed Cost per 100 Lb.	Value per Dozen, Fresh Firsts, N. Y.	Egg-Feed Ratio	Number of Eggs to Pay Feed Cost [1]	Number of Eggs to Pay All Costs[2]
1910	$1.55	$0.253	6.13	58.8	117.6
1911	1.52	0.216	7.04	67.6	135.2
1912	1.71	0.252	6.79	65.2	130.4
1913	1.53	0.248	6.17	59.2	118.4
1914	1.67	0.266	6.28	60.3	120.6
1915	1.77	0.256	6.91	66.3	132.6
1916	1.83	0.294	6.22	59.7	119.4
1917	3.13	0.403	7.79	74.8	149.6
1918	3.26	0.485	6.72	64.5	129.0
1919	3.39	0.532	6.37	61.2	122.4
1920	3.57	0.571	6.25	60.0	120.0
1921	2.01	0.405	4.96	47.6	98.2
1922	1.92	0.349	5.50	52.8	105.6
1923	2.16	0.347	6.22	59.7	119.4
1924	2.15	0.362	5.94	57.0	114.0
1925	2.40	0.398	6.03	57.9	115.8
1926	2.10	0.356	5.90	56.6	113.2
1927	2.20	0.320	6.88	66.0	132.0
1928	2.35	0.331	7.10	68.2	136.4
1929	2.12	0.370	5.73	56.5	113.0
Average	2.22	0.351	6.35	61.0	122.0

[1] Feed consumption per year considered as 80 lb. per bird.

[2] Feed cost is considered as 50 per cent of the total cost of producing eggs.

Such figures as these reveal with startling clearness the fact that the modern up-to-date poultryman must have the technical knowledge and skill to cull his flock of pullets and hens to eliminate the unprofitable birds under prevailing cost and price conditions. This chart also discloses the significant fact that by better breeding, higher and higher average income per bird may be secured. It is no uncommon thing now to find poultry farms where the average egg production year after year exceeds 200 eggs per hen. On such a farm the margin of excess net profit yielding income per hen per year would be in 1921 one hundred eggs or more and even the most unfavorable year 1917 when there would still be a margin of fifty eggs for net profit. A diligent study of all of the chapters of this book and conscientious application of the principles taught should enable any industrious poultryman to materially increase his income which otherwise might have been a year of net loss.

At all times the prevailing price of poultry meat is an important factor for consideration when culling. It is usually a safe rule to sell idle hens when they will bring the highest price.

CULLING IN THE WINTER AND SPRING MONTHS

Many poultrymen do not attempt to cull out birds during the winter and spring months. It is very important of course that sick birds shall be removed as soon as noticed. Never rely upon birds with roupy colds or in a thin, emaciated condition for egg production. This is perhaps more important during changeable weather than in the warmer months because the birds are more closely confined and hence the danger of infection of the other birds is greater.

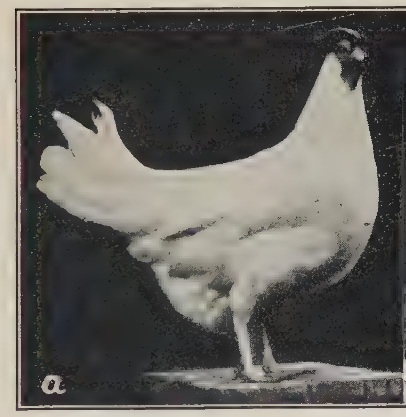
The bulk of the culling in the winter months is done in those flocks where some unfavorable condition has caused a large part of the flock to go out of production. In culling a flock under such conditions the greatest precautions possible should be taken because the distinction between the high and the low is not as clear-cut and sharp as it is in the summer and fall months. Birds which slump in production during the winter due to faulty management are likely to be among the best producers in the flock since they are the ones which are liable to lay out their body weight, owing to faulty management, thus reducing their resistance. Such birds should not be culled, but should be given special care and opportunity to recuperate. Well-balanced judgment must guide in what to take out and what to leave in. No definite rule can be laid down for guidance. So much depends upon the methods of management that have been followed. Here one is obliged to judge the caretaker as well as the hens. When birds inherit to a high degree the *urge to lay* the function of reproduction must be given proportionately better support by correct feeding and wholesome environment.

If one were to cull out the birds that had ceased production or that are rundown physically and are light in weight he might be discarding some of the best producers, or if those birds were saved that are laying, that are in good flesh and show plenty of vitality they might be ordinary to low producers. In such seasons of the year culling is not as necessary as is the segregation of the flock into groups according to physical condition. When this is done it is best to divide the flock into one group that is not laying, is light in weight and in rundown condition; another group that is in poor flesh but laying; a third group that is laying and maintaining good weight; and a fourth flock that is not laying but well fleshed and pigmented. Then handle each group according to their condition and response. The first group must be given an opportunity for complete recuperation by hopper feeding of grain and mash. The second group should be given additional grain or a slightly fattening mash in order to put on flesh. A wet mash will stimulate the appetite so that a greater amount of food may be consumed by the birds. The third group should need no change in the feeding practice. The fourth presumably should be sent to market since they are not responsive to production and are in good market condition and the market price favorable. If proper conditions of management are given it will be difficult in a few weeks' time to tell the difference between the first three groups.

CHAPTER XIII

SELECTION OF COMMERCIAL LAYERS AND BREEDERS

THE average length of life of the domestic fowl is relatively short when compared with most farm animals. Our modern methods of intensive commercial poultry culture have not aided in bringing about longer life in our domestic birds, but instead have been factors that in many instances have lowered vitality and increased the necessity for more careful and systematic selection of breeding males and females.



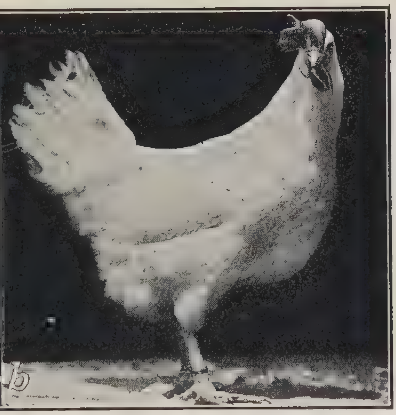


FIG. 127*a*.—Hanson's Hen No. 139.

Record 311 eggs her first year and 1341 eggs in six years. She is the granddam of many contest winning pens, including the 1929 pen at Storrs, Conn., in which ten original hens laid 2989 eggs in one year, a world's record for ten original birds. 200 of her granddaughters at home made a flock average of 259.5 eggs. A truly remarkable bird as an individual and as a breeder. Bred and owned by J. A. Hanson, Corvallis, Oreg.

FIG. 127*b*.—A Hen Built for Business.

Note her business-like attitude. She laid 315 large eggs in one year and she had the body capacity to do the job with ease. She is almost a duplicate of hen *a*. Both were produced in the United States, but 3000 miles apart.

In addition to the fact that birds normally do not live long, the period during which it is economically profitable to keep them is also very limited, so that the poultryman is faced with the problem of renewing each year 50 to 70 per cent of his flock. It should be the aim of every poultryman to replace the birds which are lost each year, through culling or mortality, with birds of equal or better quality. In order to do this, an effective breeding program must be adopted and careful selection of both males and females, which are to be used in the breeding pens, must be made.

In Chapter XII a method for the systematic culling of the farm or commercial flock was outlined. If such a system is carefully followed, there will remain at the end of the year a flock of birds from which the females that are to be used for breeding purposes may be selected. Culling differs from selection in that the former means the removal of the birds which are not producing, or which by their physical characters indicate that they are not profitable producers or breeders. Selection of breeders, on the other hand, is the separating out of superior males and females, which are to be mated and the progeny used for the purpose of replacing the birds removed from the flock each year.

The Ideal.—The ultimate object of the production breeder is to produce a strain of birds that will lay the greatest number of eggs, of highest quality, at the least possible cost per dozen eggs, or in other words, the birds that will give the greatest net profit. Such a hen must be vigorous, and alert; an efficient transformer of feed into eggs. (Figs. 127 and 128.) She must be neither too large nor too small, and there must be a proper balance between all parts of the body, and the functions which those parts are to perform. The hen must lay her eggs with such ease that she can finish the year in good physical condition, and maintain her vigor year after year. The male must give constant and effective mating service throughout the breeding season and still retain his vitality and virility, and live long.

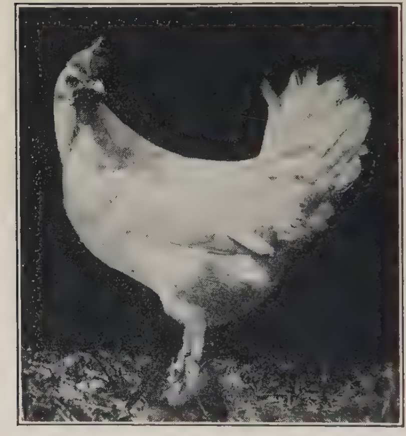


FIG. 128.—A Vigorous, Alert Individual.

THE THREE MAJOR QUALIFICATIONS

There are three fundamental characters which every bird that goes into a breeding pen should possess. The first of these is power. Inborn and developed power will be expressed in nervous energy. Every bird should have stamina, alertness, intelligence—be a storehouse of physical power. The brain is the dynamo that furnishes the power for all activity. It furnishes the alertness, intelligence, and ambition that are essential to a good egg machine. This is often spoken of as "character," and is revealed by a bright intelligent eye, a friendly disposition, and an active nervous temperament. (Fig. 128.)

The second quality is large body capacity. This includes the machinery and the room in which it functions. (Fig. 129.) The bird's digestive tract, lungs, heart, and reproductive organs, all must be strong and efficient and must be enclosed in a body frame that is large enough to allow plenty of room in which to function.

The third fundamental trait is the power to transmit the desirable characters to the progeny. If a hen is a satisfactory layer, and has not the ability to transmit this quality to her offspring, she is of no value as a breeder. This characteristic, like many others, can be detected only by keeping trapnest and pedigree hatching records and by making a progeny test.

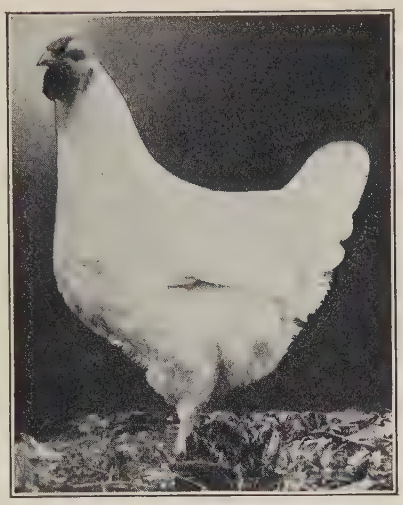


Fig. 129.—A White Wyandotte Hen With Excellent Body Type and Production Balance.

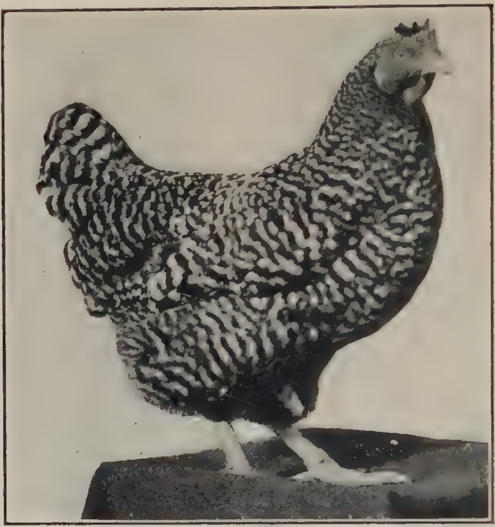
She laid 254 eggs in her pullet year.

SPECIAL CHARACTERS

There are thirteen special points which should be given consideration in selecting breeding birds, all of which are closely related to the three groups of characters just mentioned. They are given in the proper order of consideration. Several of these points are closely related, one with another.

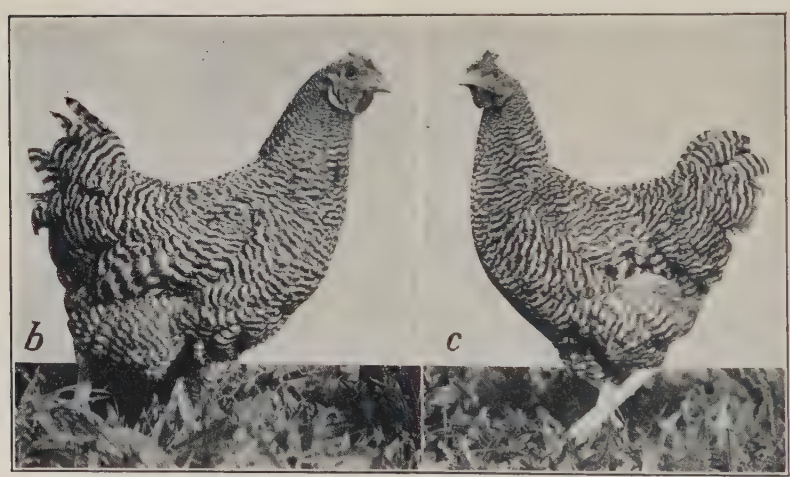
1. Breed.—The birds should be of a pure breed. The question of breed and variety is not so important and will vary with the needs of different poultrymen. It is well to select birds that possess beauty, but since the primary object is egg production, birds must be selected that are bred for production; birds that will lay well, and that will give uniform progeny that will lay equally well or better.

2. Size and Type.—A hen must not be too coarse, and yet not too refined. She must not be too large, nor yet too small. Large birds require too much feed for body maintenance, and therefore are not efficient egg producers. Small, overly refined birds may use their food very efficiently, but are unable to stand the physical strain of heavy production of large eggs over a long period of time. Breeding for the most *efficient* egg production, then, tends to bring all breeds to a common size and type—one that is midway between the heavy and the light breeds. This means that the most efficient hen will weigh from 4 to 6



Courtesy Pratt Experiment Farm.

Record 322 eggs in one year at the Vineland, N. J. Egg Laying Contest.



Record, 270 eggs.

Record, 272 eggs.

Fig. 130.—Three Barred Plymouth Rock Hens with Excellent First Year Records.

Many strains of the general purposes varieties are profitable egg producers.

pounds, depending upon the breed; she will be alert, yet docile; active, yet compactly built. When handled she must show actual body size and substance. (Figs. 127, 128, 129 and 130.)

3. Early Sexual Maturity.—Pullets should begin laying when reasonably young. By this they show that they possess the inherited tendency to produce. However, there are two factors that determine the age at which pullets start laying: (1) the inherited tendency to lay, and (2) their environment such as feed and management. The age at which high-producing pullets begin laying varies from four to seven months. A good production bred pullet, fed normally, but not forced, should begin laying at from five to six months of age. At this age she should be well enough developed to stand the strain of high production, and large enough to lay a marketable sized egg. (Fig. 131.) In a given flock these early beginners are likely to be the best layers, and should be discovered by trapnest or physical examination and kept for possible future breeders.

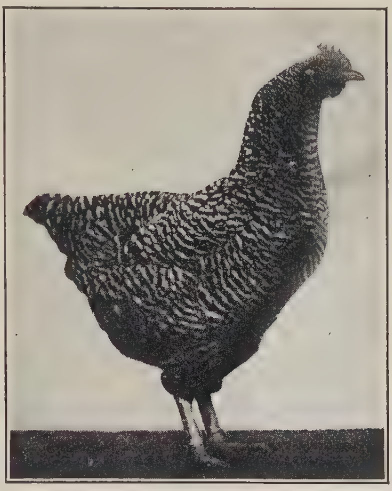


FIG. 131.—A Well-developed Barred Plymouth Rock Pullet.

4. Persistency.—Birds should have the inherited tendency to lay for a long time before ceasing. This quality may be termed "persistency." Health, vigor and an efficient digestive tract must go hand in hand with this quality. Such birds persist in their production throughout the year, and are the last of the flock to stop laying.

From this it will be seen that one should select the birds of the same variety and age that begin laying first, and again from these select the ones that stop last. A method of banding for this type of selection is illustrated in Table 11. If such a system is carefully carried out the best layers in a flock can readily be determined.

5. Intensity.—This is the number of eggs that a bird lays in a given period of time, as per week or per month. In order to make a high record a bird not only must begin early and quit late, but she must not lose much time in between. She must keep steadily at it, and this requires a strong constitution and an abundance of nervous energy. Some pullets start out strong at first, but for lack of vigor and energy are soon forced to stop and rest. Many such pullets will recuperate and begin laying again, but at best they lose too much time to give an extremely high production. Our best birds are the ones that possess an abundance of nervous energy and distribute that energy over a long period of time. By laying regularly 20 to 25 eggs per month, a bird lays a high annual production and maintains her vitality to the extent that with about two or three months' rest she is ready for another year's work.

The trapnest is the only means of determining accurately a bird's intensity. By trapping pullets any two or three months of the year it is possible to get a reasonably accurate idea of their intensity.

6. Quality of Egg.—Present market demand makes size, shape, and color of egg as important as the number laid. The three months' trapping will show these egg qualities and give a chance to select for future breeders the birds that lay the most desirable eggs. The months of March, April and May are most desirable for this short-time observation of egg weight and quality.

There is a strong correlation between the size of an egg and the size of the chick. Therefore, in order to produce large, vigorous chicks, we must hatch from large eggs. Records show that large eggs are more profitable than small eggs, because of the extra price they bring on the market. The market desires 24- to 28-ounce eggs, and will seek the man who can furnish them. Most of our eggs during the season of highest prices, September, October, November and December, come from pullets, and in order to get a 24-ounce egg weight per dozen from pullets soon after they start to lay, it is necessary that the hens which laid the eggs from which the pullets were hatched produce eggs which weigh from 25 to 28 ounces per dozen. Some poultrymen object to producing these large eggs, but they can well afford to use the 25- to 28-ounce hen's eggs in order get a large proportion of the 24-ounce pullet eggs. These 28-ounce eggs are the seed bed for future good profitable pullets and should be highly valued as such.

The most marketable egg is typically "egg-shaped." If it is too round it is likely to break at the sides. If it is too long it will be crushed at the ends. The 24-ounce, correct "egg-shaped" egg fills the carton, is not likely to break, looks well, and appeals to the eye of the buyer. Fig. 163 shows eggs of desirable shape.

Markets vary as to the color of eggs they prefer. Most markets desire uniformity of color, whether white or brown. The breeder must therefore cater to the demands of his market, and make his selections accordingly. If he wishes to produce chalk-white eggs, he must hatch from hens laying only chalk-white eggs, and great care must be exercised in selecting them. Many pullets of the white-egg breeds lay tinted eggs at first but pure white eggs after they have been laying for a short time. Such birds should not be used as breeders. Uniformity of size, shape and color of eggs requires years of careful breeding and selection. It means that birds must be pure-bred in order to secure these qualities. Fig. 132 shows the progress made in improving egg size as the result of selection of large eggs for hatching.

7. Number of Eggs.—Quantity production is an essential factor. Two hundred eggs should be the minimum for breeding. By having an intensity of 20 eggs per month, a bird can lay 200 eggs in 10 months and still have ten days' rest each month and two full months in which to rest, molt and recuperate for another year's work. A 4- to 5-pound hen with plenty of stamina and properly built can do this easily. Some do even 300 eggs with apparent ease, remarkable though it may seem. In fact, there are more 300-eggers to-day than there were 200-egg hens twenty years ago.

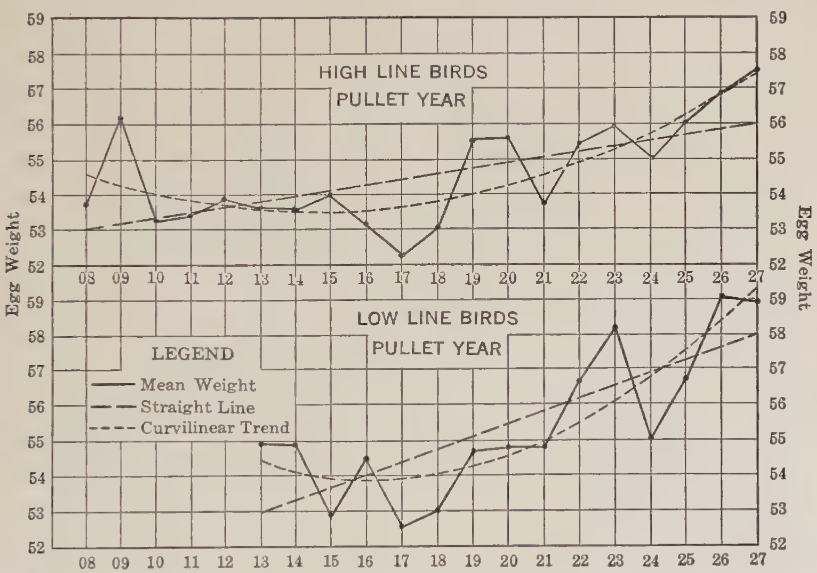


FIG. 132.—Selection for Egg Size Was Much More Rigid during the Last Part than During the First Part of the Twenty Year Period.

8. Longevity.—Longevity is the ability to live and produce over many years. This is perhaps our most important single characteristic. Many poultrymen are keeping their birds only one year, and therefore are unable to test out their breeders for longevity. Such a practice does not give a proper chance to select the most vigorous birds, and therefore must finally result in a general lowering of vitality and a shortening of the normal life of the bird. On the other hand, pedigree breeding and progeny testing depend upon long life and heavy laying to give best results. These give a chance to discover our best long-lived birds and to use them as breeders, as long as they continue to produce eggs of good quality which will hatch and give good vigorous chicks. Fig. 127*a* shows a prolific, long-lived bird. If long-lived birds are bred from year to year the chicks will inherit the factor of longevity and therefore will not be so likely to die young.

Dr. Raymond Pearl, who made a special study of duration of longevity makes the following statement with reference to duration of life as a measure of constitutional fitness.

> "If I were in a position to do so I should like to try for a period of years the experiment of breeding each year the oldest hens which could be had and from which it was possible to get any chicks at all. To insure a reasonable degree of fertility, I should use younger male birds. Such offspring as were obtained would be kept as a wholly separate flock and line-bred, working in all the time as much "high longevity" blood as possible.
>
> I feel confident, from what little I know of the biology of poultry, on the one hand, and of duration of life, on the other hand, that after about five years I should have a flock of poultry of astonishingly strong constitutions, extremely low chick mortality, and, I think, high productiveness."

Valuable as is the factor of longevity in breeding, a time comes in the life of a bird when his or her physical condition may exert a more powerful influence upon the vitality of the offspring than the inherited tendency to live long. It seems certain that the physical vigor of a chick is determined by the physical condition of the parents at the exact time the egg was fertilized and made. It is therefore good practice to breed from birds as long as they maintain their vitality and virility, and no longer.

Table 27 illustrates the decrease in production from year to year of a large number of birds over a period of several years. Out of 1434 birds all of which had at least three years record, five were left at the end of the eleventh year. These figures would indicate that it is not only profitable to keep birds for breeders for several years but that if careful selection is practiced it would pay to keep some of the best hens for commercial egg production for two or even three years. While the hens may not lay quite as many eggs as pullets, they will lay, on the average, much larger eggs than are usually produced by younger birds.

9 and 10. High Fertility and High Hatching Power.—These will be considered together because they are rather closely related. By nature there is also a close correlation between high production and

TABLE 27

DECREASE IN EGG PRODUCTION WITH AGE

Egg Group[1]	Number of Birds[2]		1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year	11th Year
51–75	62	Average production	82.4	62.2	47.5	54.0	56.6	58.8	40.3	50.5	40.7	28.5	
		Per cent of preceding year	......	75.5	76.4	113.6	104.8	103.8	68.5	125.4	80.5	70.1	
76–100	134	Average production	98.3	88.9	77.9	75.4	73.3	53.6	44.8	52.9	42.8	44.0	
		Per cent of preceding year	......	90.4	87.7	96.8	97.2	73.1	83.5	118.0	81.0	102.7	
101–125	285	Average production	125.2	111.8	101.3	94.2	81.3	78.5	68.3	64.2	46.6	24.8	
		Per cent of preceding year	......	89.3	90.6	92.9	86.3	96.6	87.0	93.9	72.7	53.1	
126–150	378	Average production	156.1	139.2	120.2	112.2	95.7	88.9	85.2	79.2	77.8	62.4	
		Per cent of preceding year	......	89.2	86.4	93.3	85.2	92.9	95.8	92.9	98.2	80.2	
151–175	426	Average production	183.9	161.3	138.8	120.8	94.0	99.6	78.6	67.6	48.4	47.7	
		Per cent of preceding year	......	87.7	86.0	87.0	77.8	105.9	78.9	86.1	71.5	98.5	
176–200	129	Average production	204.4	184.7	165.6	134.3	109.7	104.6	60.7	36.7	21.0	12.0	
		Per cent of preceding year	......	90.4	89.6	81.1	81.7	95.3	58.0	60.4	57.3	57.2	
201–225	16	Average production	233.4	208.1	191.7	125.8	170.0	106.0					
		Per cent of preceding year	......	89.2	92.1	65.6	135.2	62.4					
All Groups	1434	Average production	154.8	137.3	119.8	106.4	93.5	87.2	68.4	67.6	51.5	42.6	46.4
		Per cent of preceding year	......	88.6	87.3	88.8	87.9	93.2	78.5	98.8	76.2	82.6	109.0
		Per cent of first year	......	88.6	77.4	68.7	60.4	56.3	44.2	43.7	33.0	27.5	30.0

[1] The average production of each bird for the first three years was used as the basis for classification into egg groups.

[2] The number of birds in each group was the same for the first three years data. Decreasing numbers of birds were available for the fourth and later years.

high hatching power. If this is true, why do we so often hear the complaint that high-producing hens will not produce highly hatchable eggs? The answer is apparent. High-producing hens are called upon to produce so many eggs so continuously that there vitality is lowered at hatching time and therefore they cannot produce eggs that will hatch. If these same hens had been given a fair chance to recuperate just before hatching season and by proper rest brought into the best possible physical condition, they would in most cases give satisfactory hatching results. High-producing hens recuperate much faster than do low producers, but even the hen that lays 200 eggs in a year needs two to three full months in which to molt and get back into good physical condition before the beginning of the breeding season. Just as the ability to lay a large number of eggs is very useful in the selection of breeding females, so the ability to produce many strong, livable sperms is one of the characters to be used in the selection of males. This is shown by the male's eagerness to mate and the results of his matings.

11. Broodiness.—Broodiness is a maternal instinct that was once essential to reproduction but now has no further justification, and should be bred out as soon as possible. The inheritance of broodiness and its effects upon egg records are described in Chapters IX and XI. Since broodiness is inherited it requires close selection in order to eliminate it.

12. Reproduction.—The breeder should be a good transmitter of desirable qualities. This is one of the fundamental traits. It is only by keeping trapnest records and by progeny testing that this character can be determined. By a study of such records one will be surprised to learn how many of his best birds came from a certain male or a certain female. A bird that persistently transmits his or her superior egg-laying qualities to the offspring, shows that it is a pure-bred individual for those particular egg qualities and should be most highly valued as a breeder. Such a bird should be kept for breeding purposes as long as it lives and maintains its vitality as shown by the ability to produce many strong chicks.

13. Breed and Varietal Characteristics.—Every breeder should aim to bring his birds up to a high ideal of head points, body type, pigmentation and plumage pattern. He should not attempt to perfect such qualities until after he has steadfastly developed and fixed to a reasonable degree the thing for which he is primarily working, the most profitable hen from the standpoint of production. Egg production, with all its complications of number, size, color and shape, is a very difficult combination of characters to fix in a strain of birds, and it requires for accomplishment years of careful breeding. Perfection of plumage color and pattern is exceedingly difficult of accomplishment, requiring many years of skillful, painstaking selection and mating. Reasonably correct plumage and body characters are comparatively easy to secure

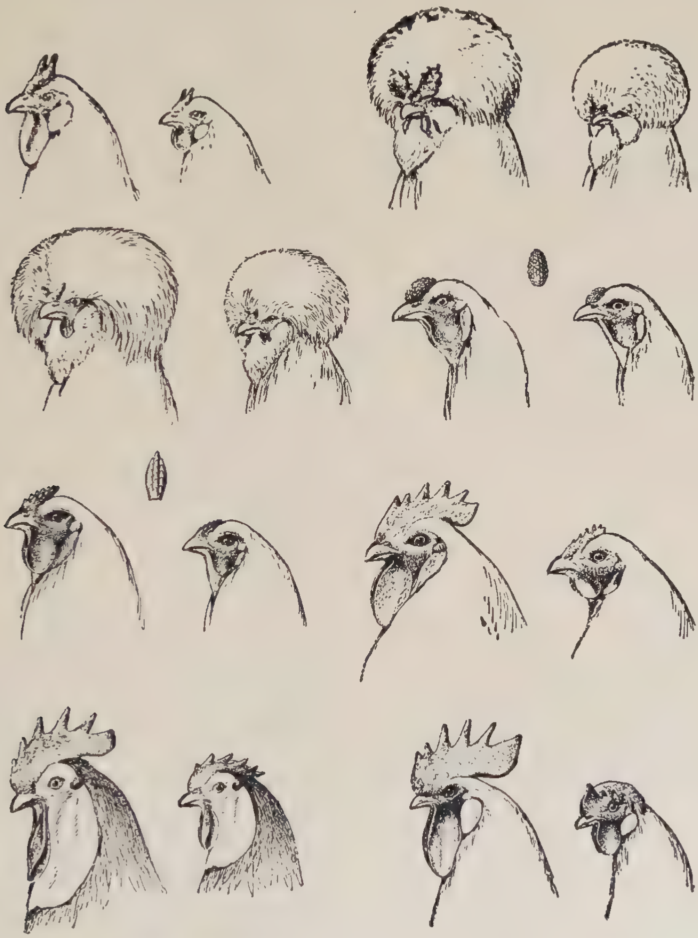


FIG. 133.—There Are Many Comb Types among Birds.

when developing a high producing strain of birds. Figs. 133 and 134 show standard types of combs. It would be unwise to discard birds because of some minor breed defect which does not influence egg production and which could be corrected in a very short time. Every bird is a compromise. No bird is perfect. When deciding upon the comparative value of two birds, each one having certain faults, the one should be retained whose faults are easiest to eliminate.

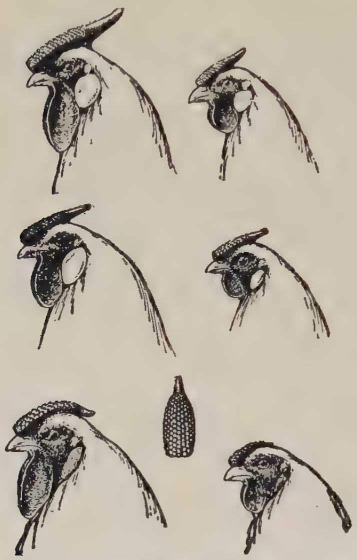


FIG. 134.—Different Types of Rose Combs.

The thirteen points, or characters, associated with egg production, which have just been described, cannot all be determined accurately by a physical examination of the birds. However, by applying the principles described in Chapter XII on culling the farm flock, and the relationships between egg production and molt as decribed in Chapter VI, pigmentation as described in Chapter V and body type and changes in physical condition as described in Chapter VIII and head type Chapter VII, one should be able to pick out the best producers from his flock without the use of the trapnest, and by continually breeding from these best birds, both males and females, the quality and production of his stock will be slowly but steadily increased.

COMMERCIAL LAYERS

If a poultryman is selecting his birds for commercial layers only, then any bird which would pass for a breeder would be desirable for a layer, except perhaps, those birds which are more than three or four years of age. The data on the relation between age of birds and their production as given in Table 27 would indicate that most birds would cease to be profitable from the standpoint of commercial eggs at the end of three or at the longest four years, and only the very best birds would be kept through the third laying year. The older birds do not lay as many eggs as the pullets and unless given very special management the eggs they do produce will be in the seasons of lower prices, so that the return per bird is likely to be less or the birds may prove to be an actual loss. However, the average production in the second year of the best third or possibly one-half of a flock of pullets is likely to be higher than the average production of the whole pullet flock.

On breeding farms, flocks are also kept for commercial egg production, and after the pullets at the end of the laying year, having been closely culled throughout the year, and then the breeders selected, there will be left a large number of birds which, though undesirable as breeders, may be used the following year with success as commercial layers. Such birds may have many indications of high production, yet due to some minor defect or standard disqualification are not desirable as breeders.

Different breeds and varieties have their own peculiar defects. These defects are serious handicaps to the value of birds if a poultryman wishes to sell hatching eggs, baby chicks or breeding birds, or to place these birds in competition in poultry shows, either in the production or exhibition classes. It should be the aim of every production breeder to have his birds as free from defects and disqualifications as possible while at the same time have them possess real production values. As an aid in selecting breeders, and birds for competition in production classes, Steup (1926) has presented a list of more common defects found on the popular breeds and varieties of chickens used for egg and meat production. This list in a modified form is presented as follows:

COMMON DEFECTS AND DISQUALIFICATIONS

Plymouth Rocks

1. Tendency towards underweight, which is very likely to be associated with small size of egg.
2. Tendency toward knock-knees, which often indicates low constitutional vigor. (Fig. 30.)
3. Males often have flat breasts. (Fig. 135.)

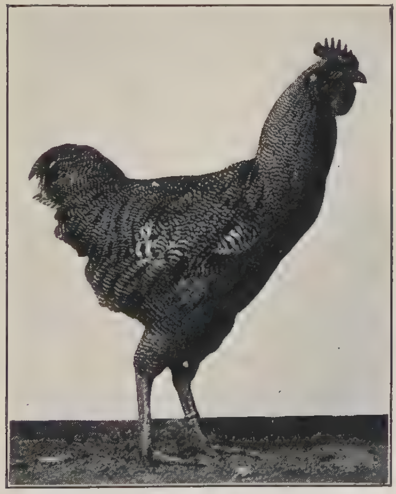


Fig. 135.—A Barred Plymouth Rock Cockerel with Long Shanks and Flat Breast.

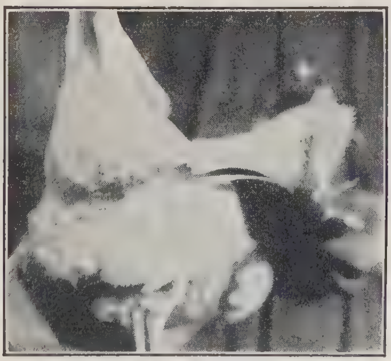


Fig. 136.—Twisted Wing Feathers. A Disqualification.

4. Combs with thumb marks, double points, wrinkles, and side sprigs.
5. Combs too large with more than five points.
6. Pale or enamel white in earlobes.
7. Tendency towards split tails in males.
8. Twisted wing feathers (main flight feathers). (Fig. 136.)
9. Green peppering and dark spots on shanks. (Plate II.)
10. Stilty, or too long legged. (Fig. 135.)
11. Bodies low set, approaching Wyandotte or Orpington type.
12. Tail carried at improper angle.
13. Narrow back at base of tail.
14. Stubs and down on shanks and toes.

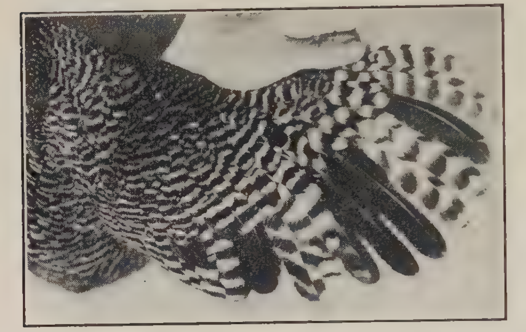


FIG. 137.—Wing of Barred Plymouth Rock Hen Showing More than Two Black Feathers. A Disqualification.

BARRED PLYMOUTH ROCKS

1. Solid black feathers in wing or main tail feathers. (Fig. 137.)
2. Smoky or indistinct barring (especially on backs of females).
3. Light and dark bars of unequal width. (Fig. 137.)
4. Bars not running straight across feathers. (Fig. 137.)
5. Green or black shanks. (Plate II.)
6. Brown tinge on surface color.

WHITE PLYMOUTH ROCKS

1. Red, black or buff in any part of plumage.
2. Creaminess, especially in quills of feathers.
3. Brassiness of plumage (having a metallic yellow color).
4. Split tails.
5. Green color in shanks.

WYANDOTTES

1. Birds too large and coarse or birds too small.
2. Too rangy, lacking full rounded breast; bodies too narrow.
3. Comb too high, too large; absence of spike on comb.
4. Comb not conforming to shape of head; double spike.
5. Sunken eyes; eyes too light or green in color.
6. Enamel white in earlobe.
7. Back too short or too long.
8. Tail carried at improper angle; tail too long or pinched.
9. Slipped or split wing.
10. Shanks too long or too short.
11. Stubs and down on shanks or toes.
12. Beefy, coarse heads.

White Wyandottes

1. Dark ticking on feathers.
2. Solid black, red or buff in any part of plumage.
3. Creaminess of undercolor.
4. Brassiness of surface color.

Rhode Island Reds

1. Birds too small or too large.
2. Males with too long shanks and shallow breasts.
3. Enamel white in earlobes.
4. Eyes too light in color.
5. Too much ticking in hackle of females; any ticking in hackle of males.
6. Narrow backs and pinched tails.
7. Stubs or down on shanks and toes.
8. Smut or white in under color.
9. Under color too light or lifeless in appearance.
10. Black on surface, especially over shoulders.
11. Slipped or split wings.
12. Surface color wine colored or too light.
13. Unevenness of surface color.
14. Too large and irregular single combs; side sprigs; uneven serrations.
15. Twisted feathers in primaries or secondaries of wings.

Light Brahmas

1. Lack of distinct contrast between black and white markings.
2. Indistinct lacing not extending around end of feathers in hackle.
3. Males lacking lacing on hackle and saddle feathers.
4. Black ticking on white areas.
5. Gray in wings; under color too light.
6. Lacing too heavy in tail coverts of male.
7. White spots on wing primaries.
8. Solid black or brown feathers on back.
9. Outer toes not feathered to the last joint.

Leghorns

1. Double points, thumb marks and too many points on single comb.
2. Large, beefy single combs; blades too heavy and turning to one side.
3. White in face.
4. Squirrel tails (carried too high); pinched tails; wry tails. (Fig. 138.)
5. Deficient breast; back slanting downward too much from shoulders.

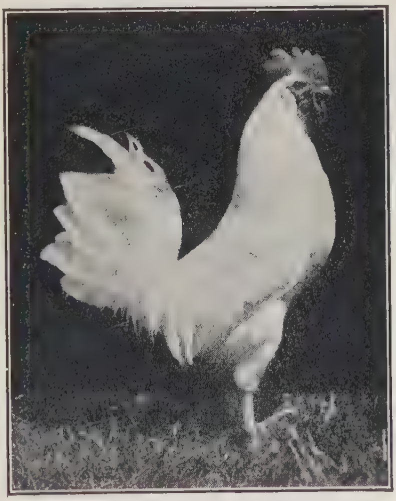


FIG. 138.—A Bird with a Squirrel Tail. A Standard Disqualification.

Single or Rose Comb White Leghorns

1. Brassiness, creaminess, red, buff, black or salmon, in plumage.
2. Red in earlobes; earlobes too coarse.
3. Body too coarse and too large; body overly refined.
4. The pouter pigeon or game type with breast too prominent.
5. Rose combs too broad; too high; hollow center.
6. Rose comb with spike following the neck.
7. Green shanks.
8. Stubs or down on shanks or between the toes.

Orpingtons

1. Birds too large or too small; body lacking depth.
2. Short back; deficient breast; narrow back and body.
3. Shanks too long; body too low set.
4. Twisted and lopped combs; thumb marks; side sprigs.
5. Heads too long and narrow; off colored eyes; usually too light.
6. Stubs and down on shanks or toes; white in earlobes.
7. Males with split tails; feathers too long or too loose.
8. Knock knees in males.

Buff Orpingtons

1. Uneven surface color; males too dark over shoulders and back.
2. Black peppering; solid black or white in wings or tail.
3. Under color too light, approaching white or being white.
4. Too dark or too light buff surface color.
5. Mealiness in females.

White Orpingtons

1. Creamy beak; shanks blue or creamy.
2. Red in hackle or saddle of males.
3. Red, buff or partly black feathers in plumage.
4. Brassiness or creaminess.
5. Black ticking.

Jersey Black Giants

1. Too small.
2. White or red in plumage.
3. Under color of black or dull black extending to the skin in hackle, back, breast, body or fluff.
4. Bottoms of feet other than yellow.

All other breeds and varieties have certain defects which it is desirable to eliminate. These are discussed in detail in the American Standard of Perfection.

Standard Weights of Common Breeds of Chickens

Breed	Cock, Pounds	Cockerel, Pounds	Hen, Pounds	Pullet, Pounds
Plymouth Rocks (all varieties)	9½	8	7½	6
Wyandottes (all varieties)	8½	7½	6½	5½
Rhode Island Reds (all varieties)	8½	7½	6½	5½
Jersey Black Giants	13	11	10	8
Light Brahmas	12	10	9½	8
Leghorns (all varieties)	6	5	4½	4
Anconas (all varieties)	6	5	4½	4
Orpingtons (all varieties)	10	8½	8	7

In selecting birds for breeders the standard weights should be considered. A bird that is very much under standard weight or very much over weight will very often be undesirable from the standpoint of breed type. Fig. 139 shows a method of weighing birds.

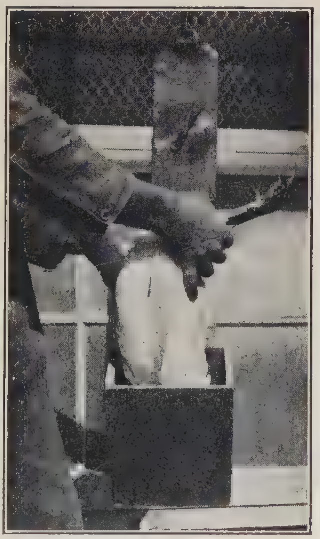
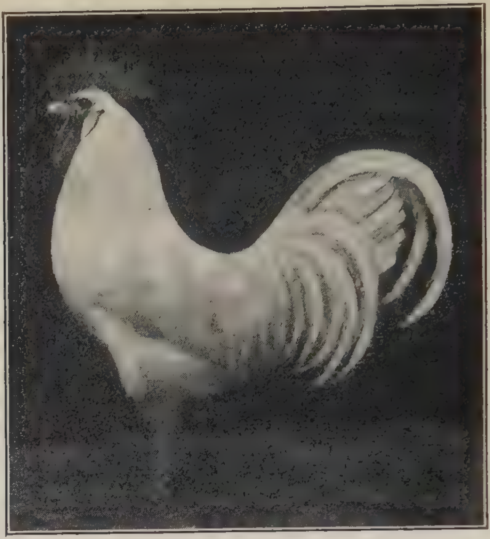


Fig. 139.—All Birds Used as Breeders Should Be Weighed. A Method of Weighing Birds.

Since the male is mated with a relatively large number of females and since in heredity the male and female apparently have an approximately equal influence on the progeny much time and care should be spent on the selection of the males to be used in the breeding pens. A male should first of all be of strong constitutional vigor, and besides possessing the qualities of high-egg production, should be free as possible from all defects. The selection of cockerels is described in Chapter XIV.

Fig. 140 shows an excellent male combining standard and production quality. His value as a breeder can hardly be estimated. Fig. 141 shows a male of the general purpose breeds, whose vigor and longevity mark him as a good breeder.



Courtesy J. A. Hanson.

FIG. 140.—An Excellent Example of a Male Combining Standard and Production Qualities.

This is the son of a 335 egg dam. This male has two generations of 300 eggers on both the sire's and dam's side. Weight, 7¼ lb.

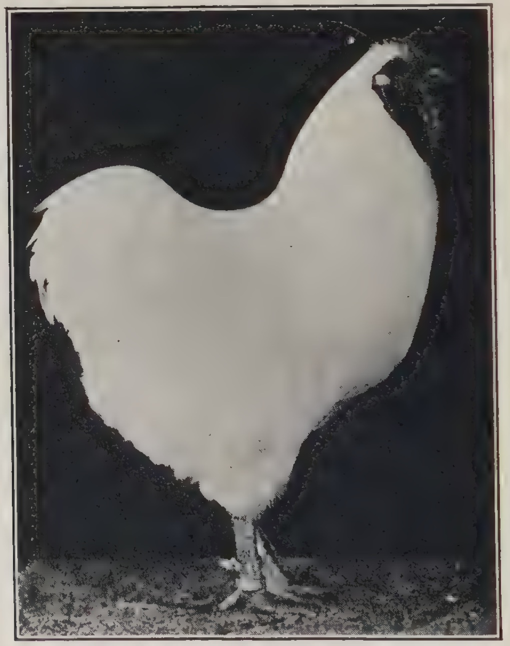


FIG. 141.—An Excellent Production Bred Wyandotte Cock.

Sweepstake cock, New York Production Show, 1924.

CHAPTER XIV

CULLING AND SELECTING PULLETS AND COCKERELS

The same principles of selection may be applied to birds of all ages from baby chicks to maturity. Each age, however, requires a different emphasis to be placed upon certain characters which are most pronounced at that particular time. In the case of baby chicks the size and plumpness of the body, fullness and brightness of the eye, color and abundance of the down, color and size of shanks and beak, and their actions are the principal characters to be considered. A little later the growth of feathers, weight of body, size, shape and color of shanks and beak, and alertness of the eye are particularly observed. A few weeks later the development of the secondary sexual characters and the shape of the body as well as the amount of pigment in the shanks and beak are given principal consideration. As the birds reach sexual maturity and take on adult form, the tail carriage, symmetry, actions, singing, cackling, crowing and gallantry may be used to best advantage.

The characters which may be used are cumulative as the chickens grow older. The characters used first, for the most part at least, continue to be observed and additional characters are developed during the seven epochs in the life of a female bird. These seven most important periods are: (1) babyhood (infancy); (2) growth (adolesence); (3) sexual maturity (puberty); (4) reproductive activity; (5) sexually dormant (molting); (6) resumption of sexual activity, and (7) old age (senility).

The judging of pullets and cockerels is considered to begin where the judging of baby chicks leaves off and continues to and includes the first three stages named.

The four outstanding objectives in the selection of pullets and cockerels are: (1) constitutional vigor; (2) size; (3) sexual maturity, and (4) freedom from serious breed and variety defects.

Judging pullets and cockerels, therefore, involves and is based upon the principles already discussed in detail in several preceding chapters and hence are not repeated in full.

Chief emphasis, therefore, in judging pullets is given: (1) to culling out defectives, (2) to selecting the choicest birds for future breeders, and (3) to dividing the remainder of the pullets into various grades of commercial layers.

The judging of cockerels like that of pullets is a continuous process. However, the males do not have as many distinct phases of development as do pullets. The first three epochs in their development are the same, except that cockerels arrive at sexual activity several weeks earlier than do the females, but they do not reach the stage of full body development until the females of the same variety and age commence to lay. The males have a continuous reproduction period but during the molt are less active sexually than at other times.

A DETAILED OUTLINE OF DEFECTS TO BE USED IN EXAMINING PULLETS AND COCKERELS

The following outline of possible defects commonly found when judging pullets and cockerels will serve to call them to mind and help the beginner to recognize them. It will require much practice and good judgment before the beginner will be able to place proper emphasis upon the comparative seriousness of the many faults which must be correctly appraised toward discarding or retaining the birds, depending upon the purpose for which they are to be used. The less the defects that must be eliminated by breeding, the greater the amount of attention that can be paid to the main considerations, the production qualities of the birds.

When making records of the breed defects of birds the only characters that need be printed on a judge's record sheet are the main factors: (1) condition, (2) deformities.

The other special defects under each section when found in judging should be written on the record. This is quicker and easier than looking for each fault on the record sheet and checking it.

JUDGING PULLETS AND COCKERELS FOR DEFECTS

Poultry Department, Cornell University

Coop No.__________ Band No.__________ Variety__________

Breed______________________________ Sex______________

Observer and Recorder____

Weight____________________ Final Grading { Approved
Conditioned
Culled

1. Condition

A. Diseased
B. Low vitality
C. Under size and weight
D. Dangerously overfat
E. Sagging abdomen
F. Pendulous crop
G. Scaly leg
H. Bumble foot
I. Poor blood circulation
J. External parasites

2. Deformities

- *A.* Rumpless
- *B.* Roach back
- *C.* Crooked back
- *D.* Crooked toes
- *E.* Wry tail
- *F.* Knock knees

3. Head

- *A.* Shape
- *B.* Comb
  - 1. Size
    - (*a*) Large
    - (*b*) Small
  - 2. Shape
    - (*a*) Straight
    - (*b*) Lopped
    - (*c*) Thin
    - (*d*) Thick
  - 3. Defects
    - (*a*) Front fold
    - (*b*) Thumb mark
    - (*c*) Side sprig single
    - (*d*) Side sprig double
    - (*e*) Split comb
  - 4. Rear blade
    - (*a*) High
    - (*b*) Twisted
  - 5. Points and serrations
    - (*a*) Too many
    - (*b*) Too few
    - (*c*) Irregular
    - (*d*) Thin
  - 6. Spike
    - (*a*) Absent
  - 7. Color
    - (*a*) Pale
    - (*b*) Purple
  - 8. Texture
    - (*a*) Too coarse
    - (*b*) Too fine
  - 9. Temperature
    - (*a*) Cold
- *C.* Face
  - 1. Color
    - (*a*) Pale
    - (*b*) White
  - 2. Condition
    - (*a*) Dished
  - 3. Feathering
    - (*a*) Partly
    - (*b*) Full
- *D.* Eye
  - 1. Color
    - (*a*) Light
    - (*b*) Pearl
  - 2. Expression
    - (*a*) Dull
  - 3. Shape
    - (*a*) Oval
  - 4. Prominence
    - (*a*) Sunken
- *E.* Eyebrow
  - 1. Overhanging
- *F.* Eyelid
  - 1. Drooping
- *G.* Earlobe
  - 1. Color
    - (*a*) Red
    - (*b*) Partly red
  - 2. Shape
  - 3. Size
    - (*a*) Small
  - 4. Fullness
- *H.* Beak
  - 1. Shape
    - (*a*) Flat
    - (*b*) Crooked
  - 2. Size
    - (*a*) Small
  - 3. Color
    - (*a*) False
- *I.* Wattles
  - 1. Size
    - (*a*) Small
  - 2. Condition
    - (*a*) Drooping

4. Neck

- *A.* Long

5. Body
    - *A.* Heart girth
        - 1. Width
            - (*a*) Narrow
        - 2. Depth
            - (*a*) Shallow
    - *B.* Loin and Abdomen (front and hip-bone)
        - 1. Width
            - (*a*) Narrow
        - 2. Depth
            - (*a*) Shallow
    - *C.* End of Pelvis
        - (*a*) Shallow
    - *D.* Back (shoulder to tail)
        - 1. Length
            - (*a*) Short
        - 2. Width
            - (*a*) Narrow
        - 3. Shape
            - (*a*) Rounded
    - *E.* Rump (back and hips)
        - 1. Sloping
    - *F.* Pelvic bones
        - 1. Narrow
        - 2. Curved
        - 3. Thin
        - 4. Thick
    - *G.* Breast
        - 1. Thin
    - *H.* Lateral Processes
        - 1. Narrow
    - *I.* Keel
        - 1. Length
            - (*a*) Short
        - 2. Shape
            - (*a*) Curved
                - Up
                - Down
            - (*b*) Crooked
                - Vertical
                - Horizontal

6. Legs
    - 1. Thighs
        - *A.* Length
            - 1. Long
            - 2. Short
        - *B.* Shape
            - 1. Thin
    - 2. Shanks
        - *A.* Length
            - 1. Long
        - *B.* Color
            - 1. Green
            - 2. Mottled
        - *C.* Shape
            - 1. Round
        - *D.* Texture
            - 1. Coarse
            - 2. Hard

7. Feet and Toes
    - *A.* Color
        - 1. Green
        - 2. Mottled
    - *B.* Length
        - 1. Long
    - *C.* Shape
        - 1. Thin
        - 2. Stub feathers
        - 3. Down
        - 4. Bumble foot
    - *D.* Defects
    - *E.* Toenails
        - 1. Long

8. Tail
    - *A.* Size
        - 1. Small
    - *B.* Carriage
        - 1. Squirrel

9. Skin
    - *A.* Color
        - 1. Pale
    - *B.* Texture
        - 1. Thick

10. Plumage
A. Color
1. Brassy
2. Foreign color
3. Color pattern defective
4. Buff breast
5. Buff shoulders
6. Smut-black

B. Type
1. Loose

C. Shape
1. Narrow
2. Defective

D. Molting
1. Neck
2. Body
3. Tail
4. Wings

E. Defects
1. Slipped wing
2. Twisted flights

11. Condition of Body
A. Hard

12. Carriage of Body
A. High

13. Reproductive Condition
A. Laying
B. Not laying
C. Coming in
D. Going out

POINTS FOR SPECIAL CONSIDERATION WHEN EXAMINING PULLETS AND COCKERELS

Selection is the first step in the process of reducing a flock of birds to lower terms by elimination. The following may be considered serious when weighing evidence for or against the birds under consideration.

1. The Condition.—The condition of a bird includes a long array of defects, many of which come directly under the term "low vitality." Birds showing these defects, because of a possible future menace and certain source of loss, should go directly to the discard coop. (Fig. 142.)

2. Deformities.—A few deformities are to be found in most flocks as a result of possible mistakes in incubation, breeding and management. The birds out of condition and the deformities are principally responsible for reducing a flock of cockerels and pullets to lower terms by the process of elimination.

3. Pigment.—In a cockerel or pullet a lack of pigment in beak and shanks indicates one of two things: it is either low in vitality or, if a pullet, it may have laid out the pigment. Other parts of the body must be examined in order to learn the reason for the loss of pigment. Lack of pigment in a yellow pigment variety female before having laid or in a male at any time is a certain indication either of a lack of vigor or the feeding of low pigment feeds. One should always look with suspicion upon the absence of a high quality of pigment.

4. The Head.—This is the most important single character to observe in selecting pullets and cockerels. One can use the head character to judge the 6 to 10 weeks old cockerels and the 16 to 20 weeks old pullets more advantageously than at any other age. The most valuable points at this age are the shape of the head, the expression of the eye, and the development of the secondary sexual characters. A skillful judge need not discard, through error, any good cockerels or pullets at the ages stated. However, he probably would retain by mistake a few cockerels and pullets which will fail to develop properly according to expectations. (Fig. 143.)

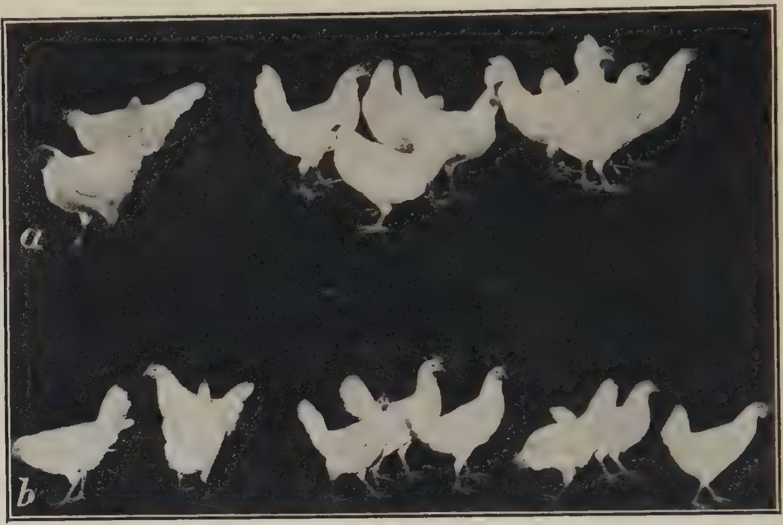


FIG. 142.—A Contrast in Leghorn Pullets.

They were selected on the basis of their size, vigor, and physical evidences of sexual maturity. Those above are more prolific, laid larger eggs and continued to maintain a heavier weight than those selected for lower vitality. The contrast between the two groups was not of the two opposite extremes of high and low vitality, since only good healthy, vigorous pullets were chosen. The contrast was more between high and medium vitality.

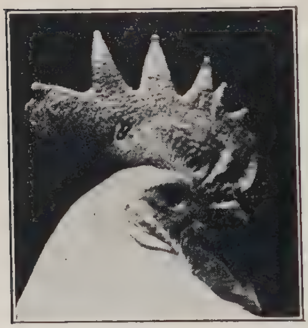


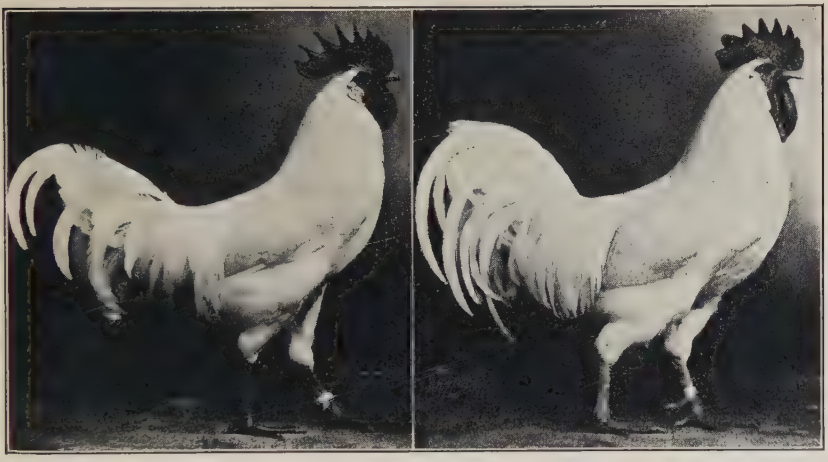
FIG. 143.—Male or Female? Which?

The head of a White Leghorn female showing pronounced development of masculine characteristics.

At an early age the head is indicative of the capacity of the body. Even a baby chick, young pullet or cockerel shows by its head and body type its capacity for long life and future production. A long, slim head and a long, thin neck suggest a long, thin body, shanks and toes. A strong head is an indication of the strength that is found throughout the body. Avoid a "crow-head," a sunken face and eye, a thin, pale or purplish comb.

The rate of comb growth may be either too slow or too rapid. If the former, the bird may not possess sufficient sex urge; if the comb has grown too rapidly the bird may be too precocious and if so the comb is liable to grow too large and lop in case of the males.

Here the environmental conditions rather than the inheritance may be responsible for the lopping of the combs. Very thin combs show weakness. Overcrowding, lack of exercise, too much heat, and too heavy protein feeds are responsible for the lopping of combs in males as truly as may be the inheritance of that fault.



Courtesy Homestead Poultry Farm, Honesdale, Pa.

FIG. 144.—*Left:* First Prize S. C. White Leghorn Cockerel in the Production Class, New York State Fair, 1926.

A promising breeder. Note the refined head; well balanced, glossy textured, well shaped comb; the bright, snappy eye; long back and good tail carriage. This bird lacks a trifle in body depth.

FIG. 144.—*Right:* First Prize S. C. White Leghorn Cock in the Production Class and Champion Mediterannean Male at the New York State Fair, 1926.

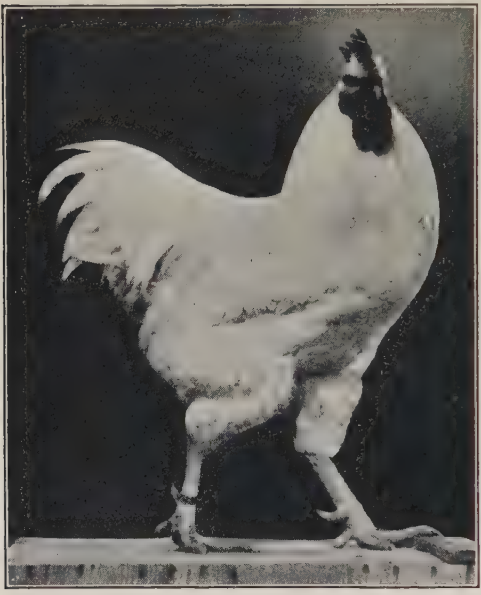
A rugged-refined head with well balanced comb and wattles. A wonderful back and depth of body. A strong boned, powerful breeder from high production ancestry. The cockerel is more refined than rugged, whereas the cock is more rugged than refined, although each one is a fine individual. With more age the cockerel will take on greater depth of body.

It is important to discard rigidly for comb faults if they show at an early age because they are liable to become exaggerated as the bird becomes older.

The eye faults of pullets and cockerels are mostly those having to do with color, a fault which seems to be difficult to eliminate from the flock.

The earlobe faults are most liable to be those of the white earlobe varieties. A slight redness is more likely to disappear than it is to increase as the bird reaches maturity and then to return with old age. Whiteness in the red earlobed varieties is likely to increase as the chickens become more mature.

5. The Body.—Although the body characters become more valuable as the bird grows older and thus becomes fully developed and solidified, nevertheless these characters may be used from the baby chick to the mature male or female. The body character can be used to the best advantage only when the age is known, since the body changes its shape so rapidly and greatly when the pullet is coming into production. A high-producing pullet takes on the hen type body several weeks earlier than do low-producing pullets of the same variety, age and management. The cockerel acquires his mature body shape at about the same time as pullets of the same age commence to lay. It is important that all of the body capacity measurements shall be made when both males and females are finally selected to go into winter quarters, since this is one of the major requirements of health and production.



Courtesy Harold Barber, Dover, Mass.

FIG. 145.—Valecroft General, Looks the Part.

A White Plymouth Rock of a high producing line. His dam laid 254 eggs her first year and 572 in three years. He is a good getter of high producing offspring. He shows masculinity to a high degree in type and action.

6. The Disposition, or Pugnacity and Gallantry.—Pugnacity and gallantry do not have the same function. The former is combative and the latter amative. Pugnacity is an expression of disposition but not necessarily an evidence of vigor. Vigor is necessary to back up the combative disposition. Gallantry is an expression of sex dominance. Both pugnacity and gallantry depend upon vitality for effective manifestation. Gallantry and high vitality are the two outstanding qualities which cockerels should possess. Together they are the manifestations of masculinity. (Figs. 144 and 145.)

DESCRIPTIVE SCORE CARD FOR SELECTING PULLETS COMING INTO PRODUCTION OR LAYING FIRST EGGS FOR R. O. P. AND EGG-LAYING CONTESTS AND FOR BREEDING COCKERELS

	Points
A. Vigor and sex dominance	15
1. General indications of health.	
2. Femininity (in pullets), masculinity (in cockerels).	
B. Breed and varietal characteristics	12
1. Type (6 points), trueness to type for variety.	
2. Color (6 points), trueness to color for variety.	
C. Head	24
1. Comb, wattles and earlobes (6 points). Cut for: too coarse, too thick, too velvety or too thin. Poor shape, lopped comb in straight comb varieties, straight comb, in lopped comb varieties, high rear blade, too many or too few points, pencil points, etc. Earlobes off color.	
2. Shape of head (8 points). Cut in case of heads too long, too short, too narrow, round on top, shallow or lacking balance. Face (3 points). Cut for enamel white in face, feathered face, sunken or fat and bloated face.	
3. Eye (7 points). Cut for: lacking prominence or proper color, dull expression or droopy eyelids.	
D. Body	24
1. Depth (8 points). Back to rear end of keel (3 points); shoulder to front end of keel (2 points); span of abdomen (3 points). Cut if shallow or narrow.	
2. Width (8 points). Heart girth (2 points); loin (small of back) (1 point); hips to rump (3 points); span of pubic bones (2 points). Cut if good width is not carried throughout all sections, front and rear.	
3. Length (8 points). Back (4 points); keel (4 points). Cut if short.	
E. Pigmentation	5
1. Deep in all sections; normal for variety, shanks, beak, etc. (Breeds with yellow skin, mature pullets with pale shanks, but showing evidences of having laid heavily, thus showing sex urge, should be credited rather than cut on account of lack of pigment.)	
F. Shanks and toes	5
1. Cut for incorrect number of toes for variety, evidences of too great refinement or coarseness, improper shape and length for the variety, and for stubs or feathers on clean shanked varieties.	
G. Handling quality	5
1. Size, shape and condition of vent. Cut for small, dry, round vent.	
2. Softness and pliability of abdomen and skin. Cut for dry, tough skin, and hard, tough abdomen.	
H. Actions	10
1. Female, disposition and laying temperament.	
2. Male, disposition and gallantry.	
Friendly, active, alert, curious; as contrasted with flighty and excitable.	

In this descriptive score card constitutional vigor and sex dominance are considered first because of first importance, but the section is not given quite as high a value as is given in most score cards because the factors having to do with constitutional vigor and sex dominance are included under several of the different sections of the bird and thus valued several times so that a bird properly scored must have had the constitutional vigor and sex dominance values fully considered. Pullets of approximately the same age should be judged together in order to give accurate consideration to sex dominance, which is largely revealed by rate of sexual maturity.

Breed and varietal characteristics are considered next. They are responsible for fixing the identity of the birds as representative of their breed and variety, which facts should be determined before undertaking to estimate production values.

The head is given the same number of points as the body type in this descriptive score card, because, although the body is not as fully developed proportionally as the head character in pullets just ready to lay or cockerels just reaching maturity, the two sections are of essentially equal value when the birds have reached full maturity. The head, since it is the most expressive part of the body, is considered before body type and is given equal value to the body. Head and body together are given 48 points, nearly half of the value of the bird. This is because they are the most important sections of a bird from the standpoint of judging for production.

COCKERELS

In the body section D, under depth, the measurement, *shoulder to front end of keel,* should be allowed 4 points for males instead of the two given for pullets and 1 point for the span of abdomen instead of the three given for pullets. Also in the same section under width, heart girth should be given 3 points in case of the male instead of 2 points given for pullets, and 1 point for span of the pubic bones instead of 2 points given to pullets.

A score card for use in the showroom is given in Chapter XVIII. This differs slightly from the descriptive score just described, due to the fact that it is used under different conditions.

SELECTING PULLETS FOR EGG-LAYING CONTESTS AND R. O. P. TRAPPING

The selection of pullets for egg-laying contests and R. O. P. trapping is becoming a well-developed science and well-established art. Those who are the most successful in demonstrating their ability to pick birds for trapping, as proven by their official records, proceed on the assumption that selection should begin several years before the pullets are hatched. This means, of course, that inheritance plays a conspicuous part. Progeny testing in order to discover prepotent sires and dams which can be counted upon to put into the bodies of their daughters the urge to lay and the power to sustain heavy production of superior quality of eggs from the first day to the last day of the laying year is becoming an essential factor in order to win consistently.

Many of the best breeding establishments are doing this type of testing. Even so, the necessity of applying the principles of judging fowls by physical examination is imperatively necessary at every stage of the procedure. Both the males and the females, before correct matings can be made, must be able to pass the physical test with a high rating before it is worth while to consider the pedigree.

The eggs and chicks or growing stock must be individually examined and re-examined before the selection of the prospective pullets is made in the fall. During all this time the pullets are going through an elimination process by which the number is reduced to lower terms and the average quality is raised proportionately. However, where the inheritance factor has been developed most successfully only a comparatively small number of birds are put to the final test since it is known in advance what each particular mating may be expected to do, so far as most of the progeny are concerned. In any event, the pullets that are the best prospects usually are placed in the trapping-house in order to learn their precocity, intensity, egg quality, and the way the birds hold their pigment and gain in weight. The trapping, though of great value in observing the laying behavior of the bird, has its hazards, since pullets which have laid are liable to have their laying cycle disturbed and be thrown out of production when sent to the contest. For those who use the trapping test, it is well to understand that the pullets should have a well-sustained body weight, high pigment retention, a good intensity, cycle of 5 to 7 or more eggs—the eggs weighing about 20 ounces per dozen, and show an active but not flighty nervous temperament (Fig. 146).

Where pullets are to be selected for commercial laying, which is by far the more common application of the principles of selection for egg production, the following steps are mentioned in the order of the usual sequence:

(1) Examine for vitality by general impression.
(2) Observe the size and weight.
(3) Study the head and comb for refinement and strength; the eye for energy and force.

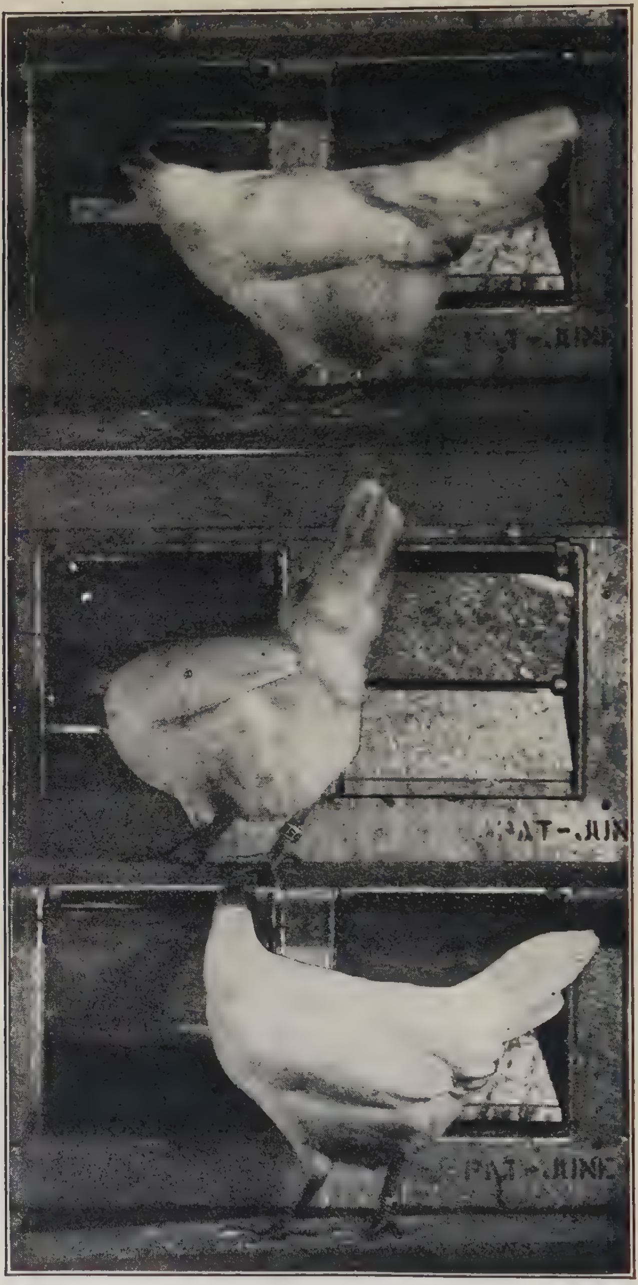


FIG. 146.—The "Urge to Lay" and Body Capacity to Sustain It.

Ideal Leghorn laying types. They know their place.

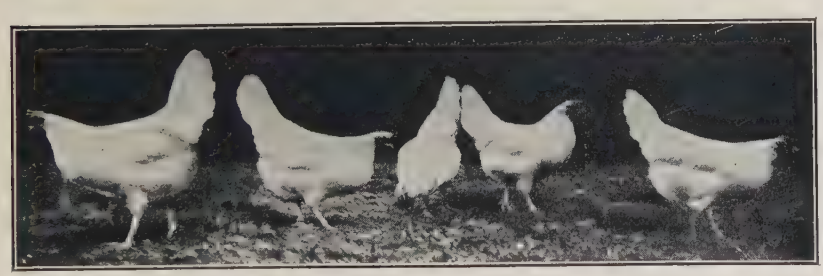
(4) Feel the body for capacity in all dimensions.
(5) Look for the more important standard disqualifications if for future breeding flocks.
(6) Look for the more important standard qualities.

When selecting cockerels for future breeding the same general procedure should be followed as for pullets. The only real difference in selecting cockerels and pullets is to look for femininity in the females and masculinity in the males.

At the time of selecting pullets to go into winter quarters those of essentially the same age should be examined together and separated into three grades based on the evidences of early or late laying. This means segregation of the pullets of the same age into early, 4½ to 5½ months, mediums 5½ to 7 months, and late, 7 to 8 months in the case of Leghorns, and about four weeks later in case of the general purpose breeds such as the Rocks, Reds or Wyandottes. When making selections of pullets it is essential that they have been kept under uniform and favorable conditions.

SELECT PULLETS AND COCKERELS FOR TYPE

Fig. 147 shows a pen of fine pullets which won honors in an egg-laying contest. They have capacity without coarseness and alertness without flightiness. They indicate their production quality by external appearances, and they prove it by the manner in which they produce. They are beautiful to look upon and profitable to depend upon. Refer to Fig. 148 and note the marked similarity between these three Leghorn pullets, winning highest honors in large production classes in production shows in the East and the five pullets, Fig. 147, winning highest honors in an egg-laying contest located more than 3000 miles away. Who can doubt the fact of an " egg type "? Study first one and then



Courtesy J. A. Hanson.

FIG. 147.—These Five Pullets Laid 1434 Eggs with a Value of $40.43.

They won four first positions. They are all daughters of a 330-egg breeder. Note how closely they conform in type to the pullets shown in Fig. 148 winners in production show classes.

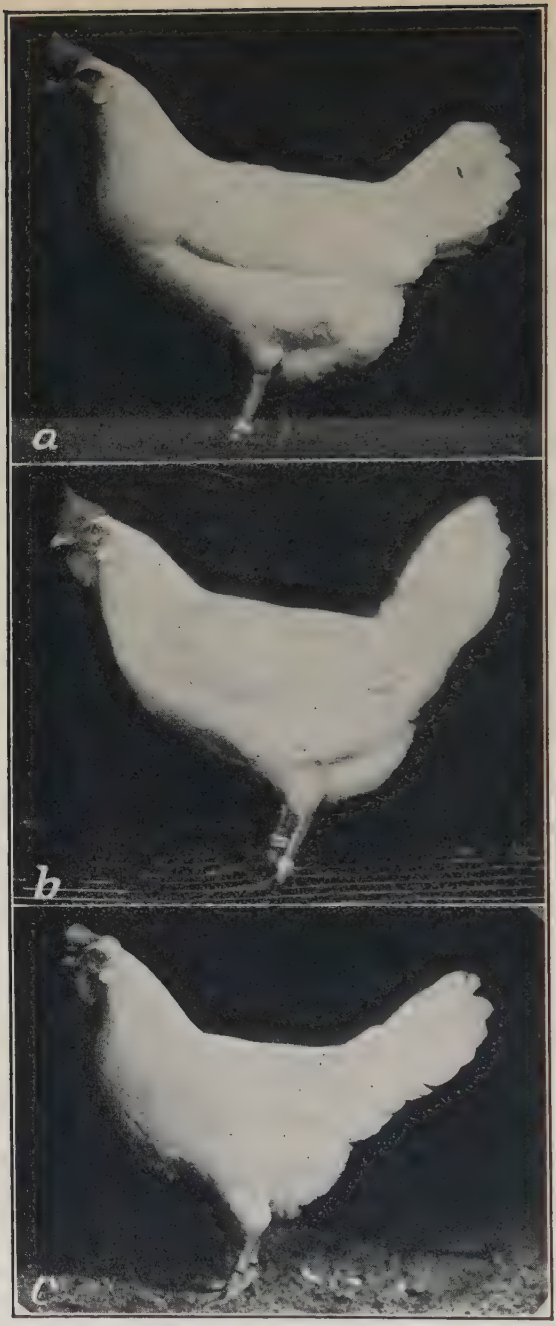


Fig. 148.—Three White Leghorn Production Bred Pullets Which Won First or Sweepstake Prizes in the N. Y. State Production Show or the Production Classes of the N. Y. State Fair.

These were judged in different years and by several different judges. They are typical of the rugged-refined-large body capacity type of Leghorn which is produced as a result of many years R.O.P. trapping and pedigree hatching where birds are selected with regard to size of bird, size of egg as well as high production. Selection based on performance is responsible for their type and not what any person thought the type should be. A nature-made, man-adopted, and not a man-conceived standard.

the other of these two groups until a correct mental picture is formed. These birds have only slight resemblance to the little, delicately built, overly refined, fashion-plate Leghorns which frequently win prizes in the so-called " Fancy " classes in many of our poultry shows.

Such wide differences should not exist in the ideals of exhibition and production breeders and judges. Fortunately for the poultry industry and particularly for the " Fancy," the number of production breeders and production judges is increasing rapidly, and the fancy breeders and the judges who are trapnesting their birds and thus acquiring the knowledge of what constitutes production qualities, are becoming so numerous that the unfortunate schism which has existed between the fancy and the production breeders and judges for many years may be expected soon to disappear, and we then shall have a common standard, combining the highest perfection of beauty and production.

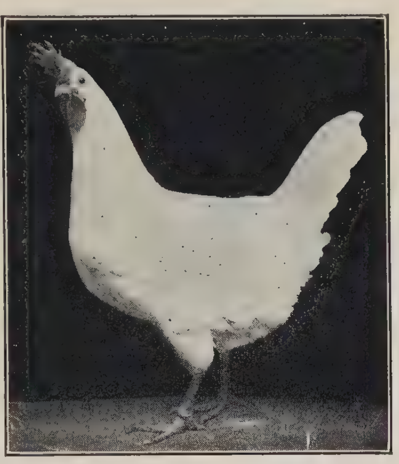


Fig. 149.—An English Type Production Bred Leghorn.

A sweepstakes winner in the "Utility Pullet" classes of an English Show. Compare with the American type shown in Figs. 147 and 148. They have many points in common. Both are large but the English type is larger. Each has the "rugged refined" head, medium to large comb. Strong shanks set wide apart. Each has a long back, deep body and very wide "saddle," i.e., pelvic region back of the hips. Each must have a wide heart girth in order to be in keeping with the other body type qualities. The English type is a little more "rangy," i.e., stands more erect and higher. The extra height is due to longer legs and deeper bodies in proportion to the length of body.

PRODUCTION BALANCE AS A FACTOR IN SELECTION AND BREEDING

Production balance is a term suggested to represent two fundamental qualities in breeding a strain of high vitality profitable producers. These are (1) the fitness and (2) the performance.

When placing awards in a showroom, or selecting birds for a breeding-pen, one must keep uppermost in mind the fact that the final selections should be based upon the assumption that they are to qualify as *prospective breeders,* insofar as this can be determined from the individual bird without having access to pedigree records. Therefore, if a wise decision is to be made with regard to " production balance," one must have a proper perspective of the comparative values of two inter-related qualities: (1) its *fitness,* (2) its *performance.* Fitness relates to size, weight and vitality; performance to the combined quantity and quality of product, that is, the number of eggs laid multiplied by the weight of the eggs.

Production balance is best understood by the use of an equation in which the body weight is on one side and the number of eggs laid multiplied by the weight of the eggs is on the other. These two sides of the equation should be properly balanced if the bird is to be an efficient, long-lived commercial layer or breeder. If a bird is well balanced for the job of efficient egg production the body weight should be in proper proportion to the total weight of the product produced in any given length of time.

Any excess body weight, other conditions being equal, would indicate reserve power or balance but would be expected to increase proportionately the comparative cost of maintenance. Conversely, any excess weight of total eggs produced would be likely to draw too heavily upon body weight but would lower proportionately the cost of maintenance.

When focusing attention upon the body-weight factor we must of course have in mind the other factors which are on the same side of the equation as body weight, namely, size and vigor. Size may be a better measure of capacity than weight, but can not be considered as a correct substitute for weight. This is because the total cubic capacity of the bird might be the same in the case of several individuals which differ widely in shape.

This problem raises the whole question as to which is of greater production value, correct shape or mere capacity. The evidence on this point is incomplete and possibly contradictory. We must await further proof before expressing final opinion. However, it can be said with confidence that size, when measured by mere height, is exceedingly misleading since it is the depth of the body from back to keel rather than from top of head or back to the bottom of the feet that indicates capacity. Refer to page 162.

Constitutional vigor is the visible evidence of "fitness," but because a bird's vitality cannot be expressed adequately in figures or words and because size of body is difficult of measurement and also of less importance than weight, the normal weight during the year for each bird is perhaps, although variable, the most feasible *mathematical* expression of fitness.

When considering production balance, each bird is a separate problem and since no bird is a perfect individual, every bird is a compromise when compared to the ideal. Hence, when several birds are under consideration it is necessary to appraise their values by balancing their faults against their virtues when considering "fitness" and "performance." In order to do this when judging for production values one must have clearly in mind an ideal relationship between "*fitness*" and "*performance*" before he can give proper consideration to *production balance.*

Moreover, *production balance* is profoundly influenced by (1) inheritance and (2) environment and management. The production judge, however, can not go back of the individual to discover whether the weight of the bird or the number of eggs laid or the quality of eggs is due to inheritance or management or both of these. He must base his decisions upon the birds as he finds them.

The poultry breeder, on the other hand, may be fairly familiar with the conditions of inheritance and management and may be able to ascertain whether a gain or loss in weight is due to the intensity of laying or the size of egg, or the method of feeding or to inheritance or to any combination of these factors. The production judge will observe several characters in order to learn the cause for the way in which production has affected body weight.

The pigment, the handling quality, the molting condition or other physical characters are likely to give a hint as to the reason for the production balance.

As an example of a purely hypothetical, approximate "production balance" in the case of individual White Leghorn hens the following figures are suggested simply as an illustration based upon a theory and not as a result of actual body weights, egg production, or egg weights of a definite group of birds. These figures nevertheless will serve to illustrate the principle involved in production balance until such time as adequate correlation tables can be provided based upon actual records of a large number of hens.

In order to show the wide variation in the "production load" which hens carry depending upon the three measurable factors, (1) body weight, (2) egg weight and (3) the number of eggs laid in one year, calculations have been made showing the importance of observing body balance in judging and breeding poultry for egg production. The results are given in Fig. 150. Here a comparison is made between hens varying in weight from 3 to 5 pounds, laying eggs varying in weight from 21 to 29 ounces per dozen and laying from 125 to 325 eggs in one year. Calculations for variations of one-fourth pound in body weight, relative to variations of 25 eggs per bird and one ounce per dozen of eggs are shown.

These figures are assumed arbitrarily for the purpose of illustration and are not to be understood as conforming to the normal relationships, which might be expected to be found in a group of hens, between body weight, egg size and numbers of eggs produced. On the contrary the arbitrary figures were chosen to illustrate the difference in the production load to prove the impracticability of breeding birds without proper regard to the harmonious relationships of the three factors: (1) body weight, on one hand, and (2) the size of the eggs multiplied by the number of eggs laid, on the other hand, which, divided by the body weight, represents the production balance.

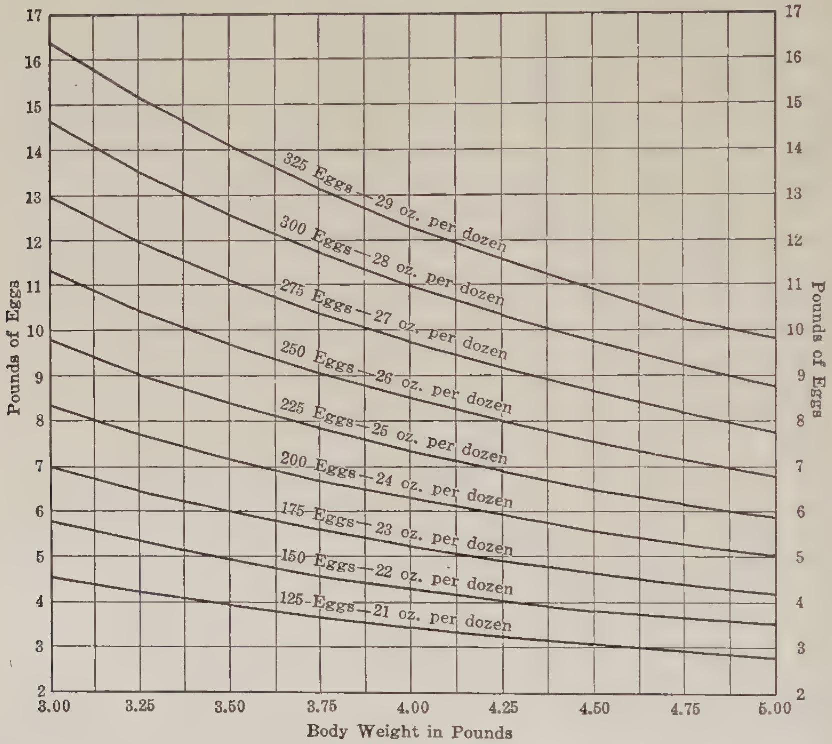


FIG. 150.—This Graph Shows the Pounds of Eggs per Pound of Body Weight that Birds of Different Annual Production, and Varying Egg Weight, Would Have to Produce When Body Weight Varies from 3 to 5 Pounds.

It is self-evident, therefore, that the proper production balance may be maintained for the same body weight by changing either of the inheritable characters, the size of egg or number of eggs laid in order to produce the same production load.

The following figures show the variation in the number of eggs laid and the size of eggs of three hens producing the same total weight of eggs.

120 eggs weighing 2½ ounces each equals 18.7 pounds
150 eggs weighing 2 ounces each equals 18.7 pounds
199 eggs weighing 1½ ounces each equals 18.7 pounds

The variation in weight of eggs is from 1½ to 2 ounces, or 18 to 24 ounces per dozen, and from 2 to 2½ ounces each, or 24 to 30 ounces per dozen, and of eggs laid from 120 to 150, and 199 eggs per year. If the hens weighed 3, 4 and 5 pounds each the production load would be 6.23 pounds, 4.67 pounds and 3.74 pounds respectively. In other words the 3-pound hen would be carrying a production load 2.49 pounds greater or nearly twice as heavy a production load as the 5-pound hen.

One can readily realize how much more heavy production of large eggs would draw upon the vitality of a 3-pound pullet than it would upon a 4- or 5-pound bird and why the problem of maintaining body weight and high pigment color in order to prevent a winter molt and pause in production is much greater with the smaller birds than it is with the larger ones while maintaining high laying intensity of large, high-priced eggs. The only possible way to meet the problem is to breed and grow large pullets in order to maintain a proper production balance.

With this explanation in mind a careful study of Fig. 150 will prove profitable. It will show how great is the difference in the production load carried by birds according to the way in which they combine the three fundamental characters which determine the production load.

The characters used in Fig. 150 will be most easily understood by comparing the size of the production load carried by birds varying in weight as shown, by noting where the plotted curves cross the intersection of the horizontal and vertical lines. For example, the number of pounds of eggs produced per pound of body weight for hens varying in production from 125 eggs to 325 eggs, and laying eggs varying from 21 ounces per dozen to 29 ounces per dozen, will be found to vary from 4.5 pounds to 17 pounds in 3-pound birds. This means that the production load varies 12.5 pounds between 3-pound birds laying 125 eggs weighing 21 ounces per dozen in one year and 3-pound birds laying 325 eggs weighing 29 ounces per dozen in one year. The same principle may be used in making any number of valuable comparisons.

Other comparisons, not illustrated in Fig. 150, may be made such as the calculation of the production load of 4½-pound hens laying 300 eggs weighing 22 ounces, 24 ounces and 26 ounces per dozen, respectively, and of 3½-pound hens performing the same service. It is interesting to learn how great a difference one pound in body weight and four ounces in weight of eggs per dozen make in the size of the production load.

Since the breeder must strive to produce 4- to 6½-pound birds, depending upon the variety, in order to secure high production of large eggs, and 24- to 27-ounce eggs per dozen in order to secure highest prices, and 200 to 250 eggs or more per year regardless of the variety, it is apparent that the three characters, (1) body weight, (2) egg size, and (3) number of eggs, must be developed together symmetrically and systematically in order to maintain a proper production balance.

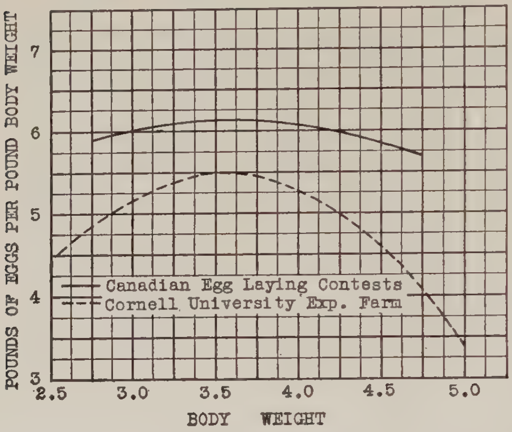


FIG. 151.—This Shows the Curvilinear Trends of Pounds of Eggs Produced per Pound of Body Weight for Different Body Weight Arrays.

The solid line shows the trend for the Leghorns in the Canadian Egg-laying Contests, whereas the broken line shows the trend for 779 Leghorns at Cornell University. The curves are quite similar in trend, although on somewhat different levels. The Canadian Contest birds reached their maximum load of 6.5 lb. of eggs per pound of body weight with the group of birds varying between 3.5 and 4.0 lb. in body weight, whereas the Cornell birds reached a load of 5.5 lb. of eggs per pound of body weight with the group averaging 3.5 lb. in body weight. The smallest load was obtained with the Leghorns weighing 4.3 lb. in the case of the Canadian birds. The smallest load for the Cornell birds was obtained with the 5.0 lb. birds.

In order further to emphasize the great importance of setting a high minimum weight for pullets and cockerels, the graph shown in Fig. 151 should be studied. These curves indicate the curvilinear trend of the three factors when a large laying population is studied.

Fig. 151 was prepared in order to show the results of a study of the production load of hens of different body weights. The data used are taken from authentic records. The curved lines on this chart show the production load of S. C. White Leghorns of different body weights. The solid line shows the condition for 5,952 Leghorns entered in the Canadian egg-laying contests during the years 1924–1927, inclusive, whereas the broken line shows the same condition for 779 S. C. White Leghorns trapnested on the Cornell University experimental farm during the years 1918–1924 inclusive.

Two important truths are illustrated in this figure. The first fact of importance is the type of curve obtained by fitting a curvilinear line to the data. The load in S. C. White Leghorns appears to be greatest with birds weighing 3.5 to 4.0 pounds. Due to lower production of the extremely small and extremely large birds the production load decreases with these birds of either extreme of body weight.

The other fact of importance is the size of the load actually carried by even the closely selected birds entered in the Canadian egg-laying contests. Six pounds of eggs per pound of body weight appears to be about the average production load. A study of the actual condition as shown in this figure further helps to emphasize the necessity for a proper balance between body weight and the other two variables, egg production and egg weight.

Facts from Canadian Egg-laying Contests Indicating the Importance of Body Weight, Egg Size and Total Production

The Canadian government was the first to establish and promote the development of official records of performance for poultry. The results have abundantly justified the effort. The United States was slow to take advantage of the example set by Canada. However, once under way in the United States, the record of performance idea has made gratifying progress. Each year several states have undertaken the project and each year the states which undertook the work earlier have increased the number of cooperators and the total number of birds being trapped.

Among the many important results which have been brought about by the adoption of record of performance work is the increasing realization of the necessity of breeding for a proper balance of several essential qualities which enter into the making of the most efficient, long-distance layers if the most economical production and best profit are to be secured.

Another striking result of record of performance management which has a direct bearing upon the quality of birds which should be selected for record of performance trapping is here quoted in full from the Blue Book of the Canadian National Poultry Record Association for 1929.

A CORRELATION OF BODY WEIGHT TO EGG PRODUCTION AND EGG SIZE IN PRODUCTION BRED POULTRY

"The question is often asked—Do birds of standard weight lay more eggs than those which are under standard weight; also do large hens lay larger eggs than small hens of the same breed or variety providing feed and environment are the same in each case?

Since egg-laying contests must of necessity be run on a standard plan, an attempt has been made to make them as uniform as is humanly possible and so far as feed, housing and management are concerned, it is fair to state that the Canadian National Egg-laying Contest (which embraces thirteen contests, at least one in each province in Canada) is highly standardized. With an institution such as this to work with, the management of the contests set out to secure figures on weight of contest birds at the end of the laying year, and if possible make a correlation of body weight to egg production.

The regulations governing registration of all birds demand that the eggs must average at least 24 ounces to the dozen during the contest year, which necessitates the weighing of eggs laid by the birds during that time and so weighings are taken at least once each week for each bird which is entered in any of the thirteen contests as conducted in Canada. With this additional information at hand we are able to present herewith a study of these three factors for the benefit and guidance of poultrymen generally.

Only four varieties had sufficient birds entered in contests to make the study truly representative. The following tables give the averages, etc., Table I. Single Comb White Leghorns; Table II. Barred Plymouth Rocks; Table III. White Wyandottes, and Table IV. Single Comb Rhode Island Reds.

So far as these figures are an indication there would appear to be a direct correlation between size of bird and average egg production in White Leghorns, a slightly less marked correlation in the case of Barred Plymouth Rocks, White Wyandottes and Single Comb Rhode Island Reds.

The figures in Table I are decidedly marked in favor of the Leghorn female weighing four pounds and over. The two groups which weighed four pounds and over are the only ones which averaged 200 eggs and over. The difference in actual production between the first group in the table and the two groups over four pounds is 49 eggs per bird. Figures of this kind are surely convincing enough to remove doubt from the minds of poultrymen as to what is the desirable size in selecting their breeding Leghorn females for 1929.

In the table for Barred Plymouth Rocks the peak of production was reached with the six to six and a half pound group, with a slight falling off in production up to the seven and a half to eight pound group. At this stage production had again dropped to about the same level as for the undersized group, those birds weighing under five and a half pounds.

The figures for White Wyandottes are quite marked in favor of the heavier birds up until the six to six and a half pound group is reached, a slight falling off for the next heavier group and then constant for the remainder of the table.

The peak of production in Rhode Island Reds was reached with the five and a half to six pound group which would indicate that Rhode Island Reds should at least reach this body weight for the best egg production.

In each of the four tables the figures show very conclusively that far too many contest birds are undersize and that an attempt should be made to improve this one factor by the selection and breeding of larger stock.

We have studied two factors so far, those of size of bird and average egg production, but a third factor is of very great importance, especially in relation to Registered poultry. Let us consider what relation there is between body size and egg size in Contest birds as brought out by the figures in the tables.

It would be difficult to secure figures for egg weights for almost 6000 Leghorn females taken from all parts of Canada that would be more convincing in favor of the heavier Leghorn. The correlation here is direct between body weight and weight of egg.

According to regulations governing Registration all the three groups in the first part of the table would be eliminated because of egg weight and it is a fact that more

TABLE I

Single Comb White Leghorns

Totals and Averages (4 years)

	Under 3 lb.			3 lb. and under 3½ lb.			3½ lb. and under 3¾ lb.			3¾ lb. and including 4 lb.			Over 4 lb. and under 4½ lb.			4½ lb. and over		
Contest Year	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight
1923–24	43	160.2	23.8	179	172.7	23.8	234	194.6	24.2	231	201.9	24.2	155	199.7	24.5	142	200	25.0
1924–25	121	164.8	22.6	380	169.8	23.3	309	187.8	23.4	324	194.5	24.1	253	206.8	24.7	71	190.4	25.2
1925–26	98	160.8	23.0	391	168.5	23.4	438	196.0	24.0	419	197.2	24.2	309	214.9	24.5	83	222.3	25.1
1926–27	96	137.9	23.0	314	158.6	23.3	378	179.1	23.7	425	192.0	23.9	376	200.9	24.4	183	206.6	24.9
Total and Averages	358	155.9	23.0	1264	167.0	23.4	1359	189.2	23.9	1399	195.8	24.1	1093	206.0	24.5	479	204.9	25.0

Total Birds represented 5952

From 1929 Canadian Blue Book

TABLE II

Barred Plymouth Rocks

Totals and Averages (4 years)

Contest Year	Under 5½ lb.			5½ lb. and under 6 lb.			6 lb. and under 6½ lb.			6½ lb. and under 7 lb.			7 lb. and under 7½ lb.			7½ lb. and under 8 lb.			8 lb. and under 8½ lb.			8½ lb. and under 9 lb.			9 lb. and under 9½ lb.		
	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight
1923–24........	248	165.1	23.5	176	180.4	23.7	210	180.3	24.0	154	176.9	24.2	86	170.7	24.5	37	159.1	23.7	13	171.0	24.3	5	181.4	24.2			
1924–25........	364	169.5	23.2	214	171.6	23.6	216	179.6	23.9	119	175.0	24.1	68	173.6	24.3	21	184.0	25.2	5	171.4	24.6	1	166.0	26.4			
1925–26........	337	177.1	23.3	215	188.2	23.8	225	184.4	23.8	141	181.5	24.1	78	196.5	24.6	45	175.5	24.5	17	176.1	24.5	6	168.3	24.8	1	96.0	25.0
1926–27........	378	176.1	23.3	246	184.1	23.6	261	184.8	23.8	130	183.1	24.1	90	179.2	24.5	32	182.5	24.8	17	152.6	25.2	1	149.0	24.0	4	152.5	25.7
Total and Averages........	1327	172.5	23.3	851	181.2	23.7	912	182.5	23.9	544	179.2	24.1	322	178.2	24.4	135	173.9	24.5	52	168.6	24.7	13	171.6	24.6	5	141.2	25.6

Total Birds represented 4161

From 1929 Canadian Blue Book

TABLE III

White Wyandottes

Totals and Averages (4 years)

Contest Year	Under 4½ lb.			4½ lb. and under 5 lb.			5 lb. and under 5½ lb.			5½ lb. and under 6 lb.			6 lb. and under 6½ lb.			6½ lb. and under 7 lb.			7 lb. and under 7½ lb.			7½ lb. and under 8 lb.			8 lb. and under 8½ lb.		
	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight
1923–24	51	131.8	22.9	35	139.2	23.2	57	162.3	23.7	48	177.1	24.2	53	184.3	24.3	39	182.1	23.4	20	161.7	24.7	5	190.2	24.6			
1924–25	27	137.4	23.9	41	168.2	23.9	59	188.2	24.0	49	187.1	23.9	42	177.6	24.5	16	191.1	24.8	7	215.7	24.2	1	202.0	22.8	1	221.0	23.4
1925–26	33	174.7	23.3	42	169.1	23.9	66	194.5	24.0	55	187.2	24.5	57	186.8	24.3	14	158.2	25.0	11	186.2	24.6	4	160.7	25.7	1	132.0	26.7
1926–27	32	144.3	23.3	44	170.4	23.8	62	161.8	24.0	66	185.8	24.0	55	198.5	24.7	31	195.8	24.7	17	171.7	25.5	1	183.0	26.9			
Total and Averages	143	145.6	23.2	162	162.6	23.7	244	177.1	23.9	218	184.5	24.1	207	187.4	24.5	100	184.4	24.3	55	176.5	24.8	11	179.9	24.9	2	176.5	25.0

Total Birds represented 1142

From 1929 Canadian Blue Book

TABLE IV

Single Comb Rhode Island Reds

Totals and Averages (4 years)

	Under 4½ lb.			4½ lb. and under 5 lb.			5 lb. and under 5½ lb.			5½ lb. and under 6 lb.			6 lb. and under 6½ lb.			6½ lb. and under 7 lb.			7 lb. and under 7½ lb.			7½ lb. and under 8 lb.			8 lb. and under 8½ lb.		
Contest Year	Total Birds	Average Porduction	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight	Total Birds	Average Production	Average Egg Weight
1923–24........	9	133.1	23.7	5	116.6	22.8	15	145.4	23.9	21	142.1	23.1	24	144.3	23.8	37	164.4	24.6	20	157.2	23.7	3	137.3	24.6	1	86.0	26.0
1924–25........	5	132.2	22.2	10	178.8	23.7	16	167.2	24.5	24	182.0	24.8	44	167.6	24.6	15	153.0	26.8	10	182.0	25.0	1	224.0	26.4	1	142.0	27.7
1925–26........	41	138.8	23.2	29	164.5	23.8	39	166.5	24.1	25	180.6	24.8	33	184.0	25.9	16	198.3	26.1	9	165.6	25.6	1	226.0	26.8			
1926–27........	17	139.0	23.7	21	161.7	24.1	32	175.0	24.3	47	177.6	24.6	34	165.0	24.7	12	176.1	24.8	13	169.8	26.2	2	154.5	24.5	1	105.0	25.5
Total and Averages........	72	137.7	23.3	65	162.1	23.8	102	166.1	24.2	117	172.8	24.4	135	166.8	24.8	80	170.8	25.4	52	166.5	24.9	7	155.8	25.1	3	111.0	26.3

Total Birds represented 633

From 1929 Canadian Blue Book

Leghorn females are disqualified for the laying of under weight eggs than for all other reasons combined.

The table for Barred Plymouth Rocks is almost as convincing as is the one for White Leghorns. The heavy Barred Plymouth Rock lays the largest egg, and the small Plymouth Rock like the small Leghorn lays the small eggs for the breed. Over 4000 birds were used in this work, which is fairly representative.

The figures for White Wyandottes are also quite conclusive in that they indicate a direct correlation between body weight and egg size for the entire table, with one slight exception, the six and a half to seven pound group, which is .2 lower than the previous group. The number of birds used in these calculations was 1142.

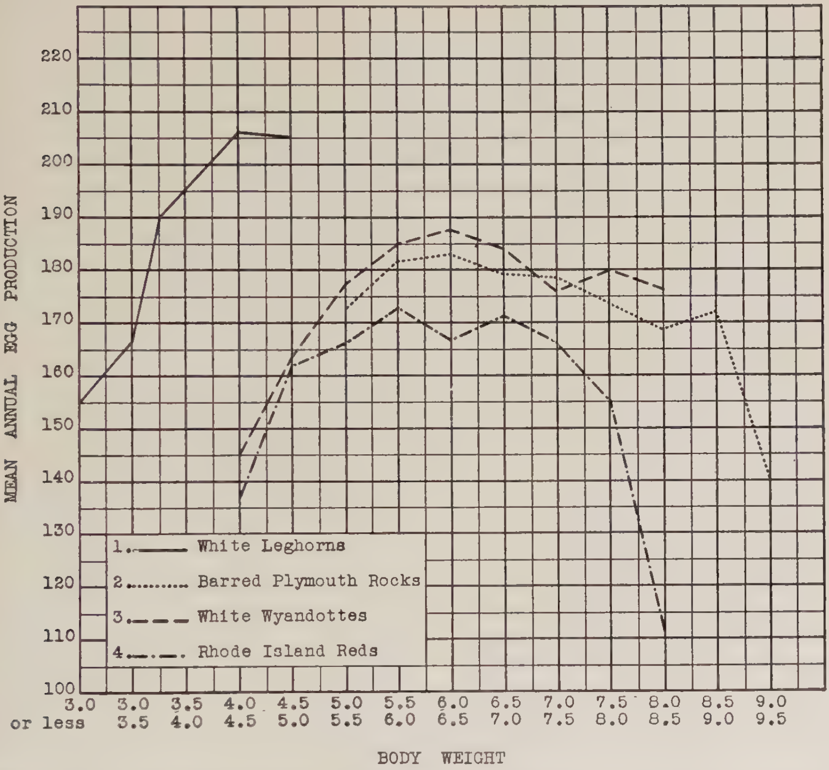


FIG. 152.—A Comparison of the Curves of Production and Body Weight of Four Breeds of Poultry.

The ranges of egg production on the left and of body weight on the bottom of the chart, show that the White Leghorns averaged to reach their maximum production of 205 eggs per bird at 4 to 4.5 lb.; the Barred Plymouth Rocks 185 eggs at 6 to 6.5 lb.; and the Rhode Island Reds at 5.5 to 6 lb. It is significant that the average production decreased rapidly after the weight reached 7 lb.

The Rhode Island Red table is very much like the one for Wyandottes in that it shows a direct correlation throughout, with one exception, in favor of the heavier birds. The number of birds used in the case of Table IV was 633.

In conclusion it is but fair to say that there appears to be—1. A direct correlation between weight of bird and egg production in Single Comb White Leghorns;

a slightly less marked correlation in the case of Barred Plymouth Rocks, White Wyandottes and Rhode Island Reds. 2. A very definite correlation between size of bird and size of egg laid in all four breeds. The birds up to standard weight for the breed laid the largest eggs and those under disqualifying weight laid the smallest eggs."

HIGHEST PRODUCTION IS BETWEEN THE TWO WEIGHT EXTREMES

In order to bring out more effectively the value of the figures showing the marked correlation between body weight, egg weight and number of eggs laid, the authors have prepared the graphs in Figs. 152 and 153, which show the unmistakable trend in breeding for properly balanced birds in four of the most popular breeds.

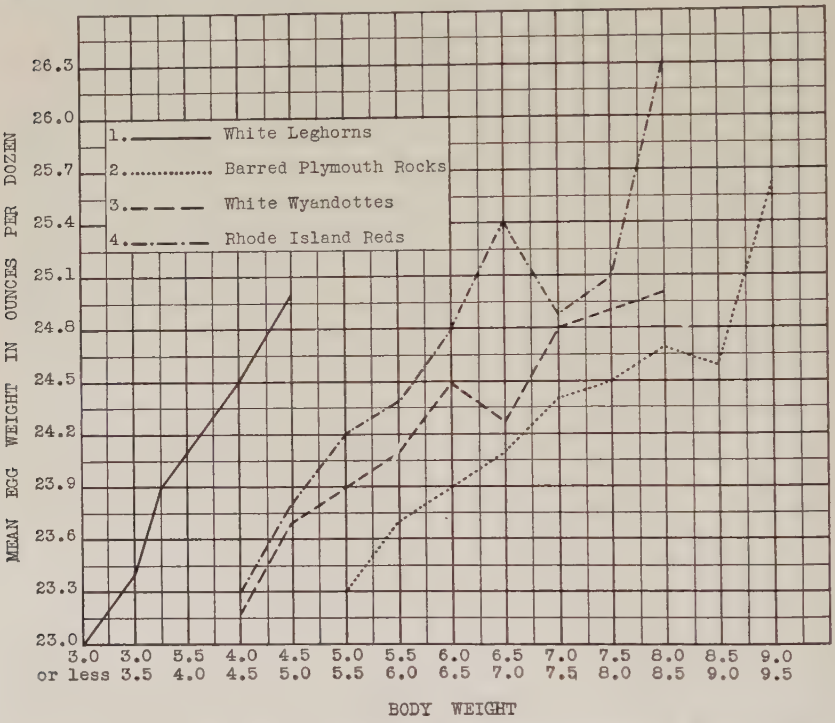


FIG. 153.—Curves Showing the Relationship between the Factors of Weight of Bird and Weight of Egg in Four Popular Breeds.

In each of these the largest average egg weight is found to occur with birds having the greatest body weight. The maximum average weights of birds and of eggs for each breed are: White Leghorns, 4.5 to 5 lb., about 25 oz.; Barred Plymouth Rocks, 9 to 9.5 lb., about 25.5 oz.; White Wyandottes, 8 to 8.5 lb., about 24.9 oz.; and Rhode Island Reds, 8 to 8.5 lb., about 26.3 oz.

The tables, descriptions and graphs show that the highest average production was secured from birds whose average weight was between the two extremes of the total breed population. This was shown to be for the different breeds as follows:

	Weight, Pounds	Average Production, Eggs
Single Comb White Leghorns	4 to 4½	206.0
Barred Plymouth Rocks	6 to 6½	182.5
White Wyandottes	6 to 6½	187.4
Rhode Island Reds	5½ to 6	172.8

By referring to the tables taken from The Blue Book, where the averages for each of the four years are given severally, it will be observed that there is considerable variation from year to year for each of the breeds. In the main, however, the relationships indicate that in order to secure best production a medium to large pullet for the breed should be chosen.

HEAVIEST HENS PRODUCE THE LARGEST EGGS

The relationship of body weight to egg weight is equally significant as summarized below.

	Weight in Pounds	Weight of Eggs in Ounces Per Dozen
Single Comb White Leghorns	4.5 or over	25.0
Barred Plymouth Rocks	9 to 9½	25.6
White Wyandottes	8 to 8½	25.0
Rhode Island Reds	8 to 8½	26.3

Here the hens within each breed having the heaviest average weight laid the largest eggs when the average weight of egg for the group was considered. However, as between the four breeds, the heavy breeds did not lay eggs of a size in proportion to the weights of the birds.

GROWTH CURVES

It is essential to have in mind when selecting pullets of any variety, the approximate normal growth curve for each variety at various growth periods from baby chicks to maturity. Such data are shown in Table 28. These data include the weights of the same individuals to 92 weeks of age.

CHANGES IN WEIGHTS OF PULLETS AFTER REACHING LAYING AGE

In Table 29* will be found statistical proof of the probable value of the weights of pullets at the time of being placed in winter quarters as indicating their future growth and production. These data throw additional light on the conclusions from the Canadian National Record Association and by the junior author.†

The fact is again emphasized that Leghorn pullets should weigh about $3\frac{3}{4}$ pounds when about seven months of age if they are to weigh approximately $4\frac{1}{4}$ pounds maximum weight during the year and about $4\frac{1}{4}$ pounds when going into winter quarters if they are to reach $4\frac{3}{4}$ pounds in weight the first year. In other words, pullets, if properly cared for, should be expected to increase about one-half pound during the first laying year and at the same time produce a satisfactory number of eggs.

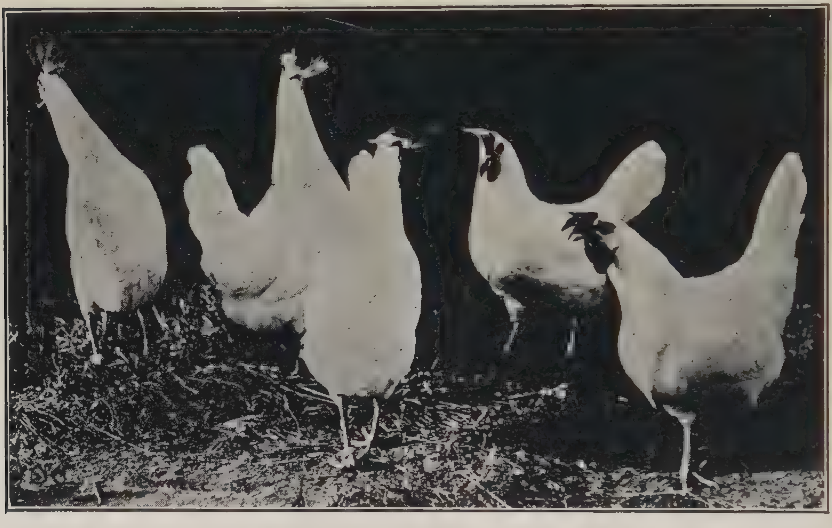


FIG. 154.—Curiosity, Alertness, Action, Intelligence and Good Health Is Exemplified in Each of the Hens in the Famous Australian Contest Champion Pen.

What wonderful egg-type bodies, medium to large combs and wattles, close fitting, glossy plumage they possess! They are an inspiration to any lover of production beauty.

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* Data by F. E. Andrews, Department of Poultry Husbandry, New York State College of Agriculture.

† Pages 287 to 294.

TABLE 28

Average Weight of a Flock of White Leghorn Females from Day-Old to 92 Weeks of Age

(Cornell University)

Age	Number of Individuals	Average Weight, Ounces
Day Old	130	1.36
1 Week	130	2.11
2 Weeks	130	3.11
3	130	4.65
4	130	6.53
6	129	10.76
		Pounds
8	128	1.05
10	130	1.47
12	130	1.85
14	130	2.17
16	129	2.39
18	130	2.62
20	129	2.78
22	130	3.02
24	130	3.17
October 3....26	130	3.66
October 17....28	130	3.75
November 1....30	129	3.85
November 16	127	3.87
November 28	127	3.90
December 13	127	3.88
January 16	124	3.87
February 20	120	4.00
March 12	118	4.15
April 12	115	4.06
May 13	113	4.08
June 12	107	3.98
July 12	106	3.94
August 12	105	3.99
September 12	102	3.95
October 12	65	3.82
November 12	65	3.88
December 12	59	3.75
January 11	55	3.97

The highest production apparently was secured from birds reaching a maximum weight of $4\frac{1}{4}$ pounds during the first year. The approximate age when the maximum weight was attained was shown to be in March, April and May for the birds weighing 4 to $4\frac{1}{4}$ pounds each.

This would indicate that these birds continued to grow until March or April. Then owing to heavy production and changes in physical condition their weights gradually decreased until the end of the laying year.

TABLE 29

WEIGHTS OF WHITE LEGHORN PULLETS AT 30 WEEKS OF AGE AND MAXIMUM WEIGHT DURING FIRST LAYING YEAR

(Hatched April 5, 1929—30 Weeks Old November 1)

(Cornell University)

Number of Birds	Average Production, Eggs	Weight at 30 Weeks, Pounds	Average 30-Week Weight, Pounds	Average Maximum Weight, Pounds
3	237.0	Under 3.00	2.94	3.19
3	223.0	3.00–3.25	3.15	4.04
16	222.3	3.25–3.50	3.39	3.76
16	208.0	3.50–3.75	3.57	3.89
30	221.3	3.75–4.00	3.79	4.21
23	209.6	4.00–4.25	4.10	4.66
12	196.2	4.25–4.50	4.36	4.82
5	204.5	4.50–4.75	4.68	5.05

TIME AT WHICH MAXIMUM WEIGHT WAS ATTAINED DURING FIRST LAYING YEAR

	Group Weights at 30 Weeks of Age, in Pounds							
	Under 3.00	3.00–3.25	3.25–3.50	3.50–3.75	3.75–4.00	4.00–4.25	4.25–4.50	4.50–4.75
November	......	......	......	2				
December	......	......	......	......	......	......	1	
January	......	......	......	2	......	1		
February	1	......	3	......	2	......	1	2
March	2	1	6	3	14	3	3	2
April	......	......	1	3	3	3	2	
May	......	1	2	1	3	7	3	1
June	......	......	2	1	3	1	1	
July	......	......	......	1	......	1		
August	......	1	......	2	......	3		
September	......	......	2	1	5	3	1	
October	......	......	......	......	......	1		
Total	3	3	16	16	30	23	12	5

CHAPTER XV

JUDGING BIRDS FOR MEAT PRODUCTION

In judging birds for their productive ability we must always consider the purpose for which we are selecting the birds. Not all of the characters that are used in judging birds for egg production, as previously discussed, can be used in judging birds for meat type. In some instances we will find that the undesirable characters from the standpoint of egg production are desirable ones when we make the production of meat the object of our selection. However, this is not always true because certain characters that are essential in a good egg producer are likewise just as essential in a good meat producer. Within any one breed the activity of one hen may be to make money out of eggs while for another hen it is to make money out of meat. When an entire breed is taken as a whole we will find that each breed is adapted for the production of eggs or meat or both.

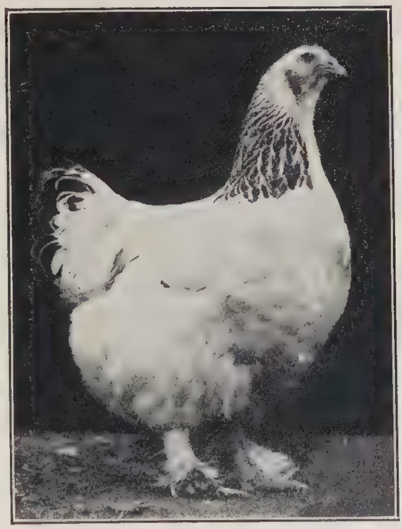


Fig. 155.—The Brahma Belongs to the Asiatic Class and Is an Excellent Meat Fowl.

The different breeds as classified in the American Standard of Perfection are usually reclassified according to their economic value. The first division should be into two classes: (1) the productive and (2) the ornamental breeds. The productive breeds are those which manufacture eggs or meat in sufficient quantity so that they can be profitably bred for that purpose. The ornamental breeds are those which are bred for their plumage or some peculiar character but have failed as efficient food producers.

The productive breeds are further classified according to the purpose for which their type is best fitted. This classification is usually:

(1) egg breeds, (2) general purpose breeds and (3) meat breeds. The Mediterranean class closely conforms with the economic group called egg breeds; the American and English classes fit the general purpose division, and the Asiatic class is primarily a meat class. (Fig. 155.) The meat breeds are not common in this country but are bred extensively in foreign countries.

DETERMINATION OF AGE

Age is one of the most important factors affecting the quality of a live or dressed fowl. As the bird grows older, the connective tissues surrounding the muscle fibers become thicker and tougher. The flesh tends to become coarse and the flavor of the bird becomes stronger. For this reason the practice of caponizing has been developed in order to prevent the male birds from undergoing these changes.

The market men determine the age of dressed poultry by the hardness and firmness of the end of the keel or breast-bone. In case of young birds the rear end of the keel bone can be easily pressed from side to side, but as the bird becomes older this bone hardens and loses its flexibility. As the bird increases in age the comb and wattles increase in size up until the time of maturity. When the bird has reached maturity the size of the comb and wattles is of no value in age determination. The face and wattles of the heavier breeds tend to wrinkle and in old birds these wrinkles become very pronounced. Other indications of age are the long hairs on the bird's body, coarseness of the feet and toes, loose scales on the shanks, and in case of males the development of spurs. Spur development does not take place on female birds except in rare cases. The spurs on the male appear early in life and grow longer each year. By an examination of the spurs of the males it is possible to separate the birds that are less than a year old from those that are between one and two years of age or those that are over two years of age.

These characters that are used in estimating the age of chickens are of little use in estimating the age of ducks and geese. The common method of determining the age of these birds is by pinching the trachea. The young birds are not as hard in the trachea as the older birds.

DETERMINATION OF SEX

Another consideration is the sex of the bird. Males are tougher and more strongly flavored than females of the same age. The males can usually be segregated from the females by their coarse bones, large comb and wattles, and the spur development. This segregation in case of some breeds cannot be made until the birds are several weeks of age. The Leghorns can be divided into the two sexes early in life because the comb begins to develop when the chicks are quite small.

The judging of live birds for meat purposes has not attained the same interest or popularity in the United States as the judging for standard or production qualities. On the average farm the cull hens are sold when they cease production and little regard is given to the production of high quality meat fowls. In limited regions interest has been developed in the production of capons, broilers or high quality roasters.

JUDGING LIVE POULTRY

On page 302 is given a score card used at Cornell University for judging live poultry for meat production. Three large divisions are made in this score card, 30 points being allowed for general appearance, 20 points for the head and neck, and the balance of 50 points for the body and legs.

The 30 points allowed for general appearance, the first division, have been divided into several smaller units. Weight of the bird is given 4 points, type and vigor of the bird each 6 points and condition and quality 7 points each. Each of these sections will be considered separately.

General Appearance. *Weight.*—The weight of the bird will vary according to the age and breed. It is impossible to judge a meat class of live birds properly when birds of all ages and weights and often several breeds are represented in the class. Broilers or fryers must be judged separately from roasters. One of the greatest defects in the arrangement of the classes in many of the production shows is the provision for a meat class because ordinarily all breeds are eligible to this class and as a result a heterogeneous group of birds is assembled, many of which are not of meat type. The ideal weight for a meat bird is about 5 to 8 pounds. The average Leghorn hen is too small to serve as an ideal meat fowl. Birds of the Plymouth Rock, Rhode Island Red or Wyandotte breeds are about the proper size for meat production. The lighter birds will dress off more relative to their live weight than the larger birds.

Type.—The ideal type of meat fowl is one which has a compact body. It is natural for the individual bird to vary in type depending on its breed. For this reason some breeds are less popular than others. The large, rangy type of body is not as desirable as the shorter leg, and more compact body. In many of the crosses made for meat fowls

JUDGING MARKET POULTRY

Score Card

	Score						
A. GENERAL APPEARANCE: 30 Points	Breed						
	Bird No.						
	Sex						
1. *Weight*—according to age		4					
2. *Type*—compact, conforming to breed		6					
3. *Vigor*—vigorous and active, showing strong character		6					
4. *Condition*—face and head bright red, eye prominent and full, well fleshed throughout		7					
5. *Quality*—bones, moderately fine and short, skin and scales soft, flesh fine texture, evenly distributed		7					
B. HEAD AND NECK: 20 Points.							
1. *Head*—short and broad, not coarse or crow type		5					
2. *Comb*—medium in size, bright in color, fine in texture		3					
3. *Beak*—short, stout, broad at the base, well curved		3					
4. *Eye*—Prominent and bright		2					
5. *Face*—Well fleshed, not wrinkled		2					
6. *Wattles and lobes*—medium in size, fine in texture		1					
7. *Neck*—moderate in length, well joined to head and shoulders		4					
C. BODY AND LEGS: 50 Points.							
1. *Shoulders*—broad and rather flat on top		4					
2. *Back*—broad, width well carried back, well fleshed over pubic bones		8					
3. *Breast*—moderately deep, wide, full and round		10					
4. *Keel*—long and straight, covered with flesh throughout		12					
5. *Feathering*—short and not profuse		4					
6. *Thighs*—medium length, plump		6					
7. *Legs*—medium short, thick and set well apart, strong but not coarse		6					
TOTAL SCORE		100					

Disqualifications: Unmistakable signs of disease.

the rangy type of either the male or female is used in order to get larger size. The compactness is obtained from one of the smaller breeds.

Condition.—Condition is very important. The larger proportion of the live poultry is consumed by the Hebrew population and they demand a healthy appearing bird. The face and head should be bright red, the eye prominent and full, and the plumage in good condition. The bird should be well fleshed throughout. Unmistakable sign of disease is ordinarily considered as a disqualification in case of meat classes. The term "cull" is often misused. From the standpoint of the egg producer a bird may be a cull while from the standpoint of the market that same bird would not be considered as a cull and should not be designated as such.

Quality.—The last point under the general appearance is quality. The bones should be fine rather than heavy and coarse, and the flesh should be fine textured and evenly distributed throughout the body. A hard lump of fat in the abdomen of the bird is no more of a credit to a meat bird than it is to a production or an exhibition bird. (See Fig. 156.) The skin and scales on the legs and toes should be soft and fine rather than rough and coarse. It has been emphasized in the discussion of physical condition as affecting egg production that the thin, pliable skin was more closely associated with good production than a coarse, thick skin. It was further pointed out that the thickness of the skin of a bird was a good index of the thickness of the intestinal wall. It is just as essential to have a thin skin on a meat bird as on an egg producer.

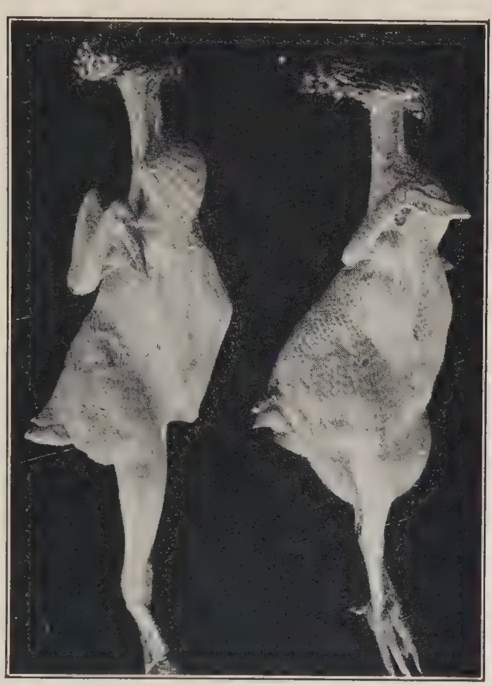


Fig. 156.—The Bird on the Right Has a Broken-down Abdomen. The One on the Left Has a Pendulous Crop.

The birds are undesirable for market. Such birds lower the price received for market poultry.

Head and Neck.—The second division takes up the different parts of the head and the neck. The shape of the head is allowed 5 points in the score card presented on page 302. Many persons are inclined to refer to a coarse, unrefined type of a head as a good meat type. This is not generally true. A good meat bird should not have the coarse, beefy type of head that is discredited in the production classes. We must expect that the head of a meat bird will be more heavily fleshed than that of an egg producer, but the presence of wrinkles or evidences of a coarse type are undesirable. The head should be relatively short and broad. There is a close relationship between the shape of the head and the shape of the body. Hence, the short, compact type of head is ordinarily found on the bird having that type of body. Crow-headed birds are just as undesirable meat producers as they are egg producers.

The comb is allowed 3 points in the score card. A large, coarse type of comb is undesirable on a meat bird because of the effect on the dressing percentage. A comb of medium size, bright in color and fine in texture is ideal for a meat fowl. The fine-textured comb of the egg producer is also just as desirable in a meat bird because of the relationship between texture of the comb and the skin quality.

A short, stout, well-curved beak which is relatively broad at the base is preferable. This type is associated with a compact body. Three points are allowed for the beak.

The eye and face are given two points each. A bright, prominent eye is desired. The face should be full and show good fleshing but a bloated or heavily wrinkled condition is undesirable. The wattles and earlobes will also show the fineness of skin as indicated in the comb.

A neck that is moderate in length will be found on a bird with a compact body. The long, crow-headed type of bird will show the long neck that goes with the body of that type.

Body and Legs.—The points so far discussed help to indicate what may be found when the feathers are removed from the body. The body should be heart-shaped because greater compactness is procured and this type will give the greatest number of desirable cuts when carved for the table. The shoulders should be broad and rather flat on the top. The back should be broad, with the width well carried back to the rump of the bird. The pubic bones should be well fleshed yet not stiff and hard. Internal fat is desposited over the ends of these bones and by examining them the amount of fat present in the body can be gauged fairly accurately. The back should be well fleshed but not too fat. A large bunch of fat on the back of the bird does not look well or in case of dressing for packing will not pack well. The shoulders are allowed 4 points in the score card shown on page 302 while the back is given 8 points.

The breast has an allowance of 10 points placed upon it. Its importance can be indicated very well by comparing the points allowed for it to the number allowed for some of the other characters. The breast should be moderately deep, wide, full and round. When great depth is obtained there is danger that it will be poorly fleshed.

The keel bone is given the greatest amount of emphasis in the live poultry score card. A long, straight keel is more desirable than the curved type of keel. This character can easily be used for determining the fleshing condition of a live bird and because of that use it is given greatest emphasis.

The thighs should be of medium length and well fleshed. A solid, heavily fleshed thigh is desirable on a meat bird. The legs should be relatively short, thick and set well apart to get good width to the body. Coarse legs are not desired, but neither are extremely fine-boned legs considered ideal.

The wings, like the other parts of the body, should be short rather than long. The wings do not furnish a large amount of meat, and for that reason the minimum size is preferable.

The feathering over the body should be short and relatively close. Some breeds are very profusely feathered and these will have a high dressing percentage.

JUDGING DRESSED POULTRY

The exhibiting of dressed poultry is most important in the Canadian Provinces. The Middle Western States probably rank next to the Canadians, while either coast of the United States gives little attention to this phase of poultry judging.

The following score card suggested by Herner of the Manitoba Agricultural College may be used for this purpose. This is adapted for the scoring of individual entries of dressed chickens.

Appearance.—Birds should be killed by bleeding and sticking. Any birds killed in any other manner should not be allowed in competition. The whiteness of the skin is the guiding factor in determining the proper cut to be made on this section in scoring. Improperly bled birds will show some reddish appearance of the skin. Birds that are properly plucked should be dry picked and all feathers removed from the neck down to the head. In some classes the wing tip and hock feathers may be left on. In all other classes these feathers should be removed.

Proper dressing refers to the cleanliness. The mouth and throat should be washed clean of clotted blood, the head washed clean, the body kept unsoiled and the feet absolutely clean.

Birds may obtain bruises in two different ways. The skin may be torn in picking the birds or the carcass may be " barked " or pealed by rubbing up against something before it is properly cooled. This causes a reddish area on the carcass which greatly detracts from the appearance.

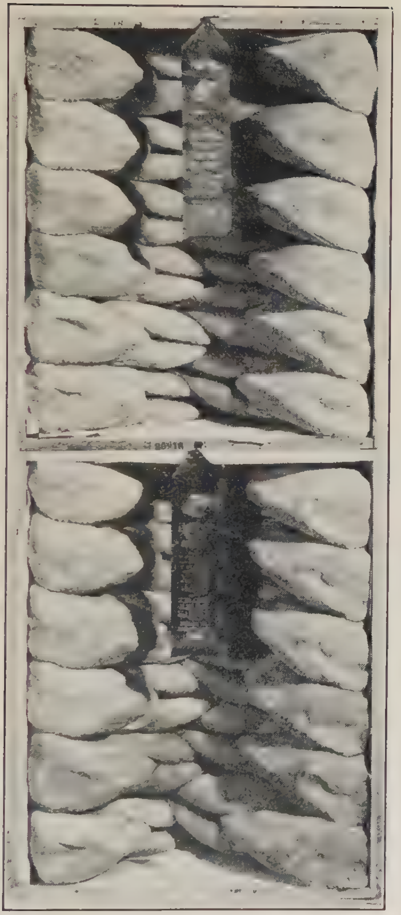
SCORE CARD FOR DRESSED POULTRY

Appearance—35 points	
Properly killed, bled, plucked, shaped and dressed	10
Freedom from bruises	10
Absence of pin-feathers	5
Straight, long breast bone	10
Quality—30 points	
Fineness of skin and scale on legs	5
Texture and grain of meat	5
Age and condition of carcass	5
Size and pliability of spur	5
Well fattened	10
Fleshing—35 points	
Covering of breast bone	10
Depth and width of breast	10
Covering of back	5
Covering of pubic bones	5
Absence of patchiness, especially in fowl	5
Total	100

Pin-feathers also detract from the appearance of the entry or from the individual carcass exhibited in the display window of a butcher shop. These pin-feathers are particularly noticeable on birds having dark colored plumage. They may be above the skin or in certain seasons of the year they may be just beneath the skin but showing through. It is difficult to remove the latter kind without injuring the skin of the bird.

The breast-bone should be straight and long. Short breast-bones allow the abdomen to overhang and also such a type will not carry the largest amount of flesh. Slight dents in the straightness of the bone should be cut lightly in scoring, while crooked breast-bones should disqualify the bird. The length of the breast-bone will vary in different birds because of difference in type of bird as well as the comparative size of the birds. The length should be measured in proportion to the relative size of the bird.

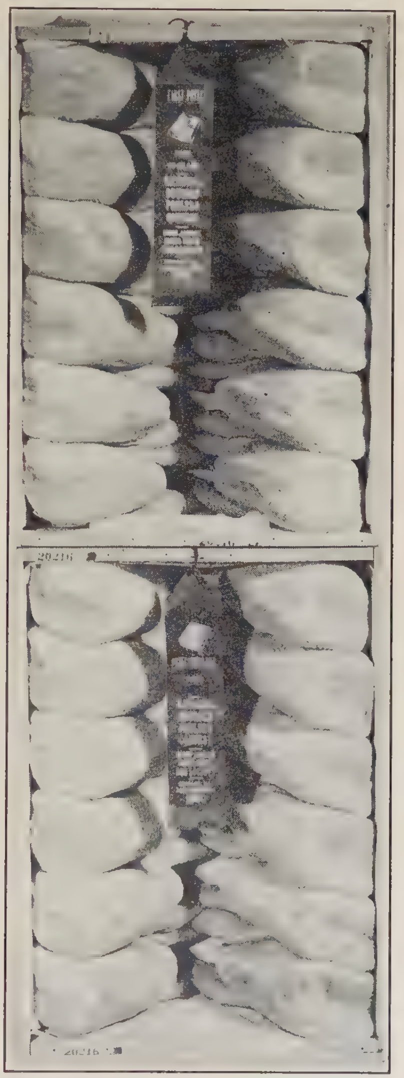
Quality.—The quality of the skin may be used as a guide to the quality of the flesh. The fine skin and close-fitting scales will be found on birds of the best quality whereas the coarser skin and scales indicate poorer quality. The texture and grain of the meat are also indi-



Courtesy United States Egg and Poultry Magazine.

FIG. 157.—Sweepstakes Roasting Chickens Exhibited at the Third National Dressed Poultry Contest.

This entry was packed and exhibited by the Humboldt Creamery & Produce Co., Humboldt, Iowa.



Courtesy United States Egg and Poultry Magazine.

FIG. 158.—This Entry of Two Boxes of Dressed Fowls Exhibited in the 60-65 Lb. Class Won the Sweepstakes Ribbon at the Third National Dressed Poultry Contest.

They were exhibited by Humboldt Creamery & Produce Co., Humboldt, Iowa.

cated by the firmness of the fleshing and the smoothness of the skin and the scales.

The age of the carcass as considered in the score card for dressed poultry does not refer to the age of the bird before killing but instead to the length of time since the bird was killed, and the condition refers to the state of preservation that the carcass exhibits. The fresh-killed carcasses are given great preference. The age of the bird before killing is determined by the length of the spur in case of male birds. The small, tender spur is associated with the better quality of meat.

Fleshing.—The covering of the breast-bone is probably the most important point to be considered. This is because the breast-bone is so prominent since the bird is displayed with the breast up. The breast-bone should be covered the entire length and it is desirable that it should be level when the bird is placed on its back. The depth and width of the breast give the bird plumpness and these two qualifications with a well-covered breast-bone determine the amount of white meat. The larger amount of white meat available, the more desirable the bird.

The covering of the back is also a characteristic which should be considered. A well-fleshed back is preferable, owing to the better flavor and roasting quality.

Well covered pubic bones indicate that the bird has had some special fattening. These last two points will also be of importance in determining quality as well as fleshing.

By patchiness is meant the deposition of internal fat underneath the skin in certain sections of the body. This is undesirable, because of the appearance and also because of the danger of excessive amounts of it. On the other hand it is possible to have birds that are not fattened sufficiently. This is a serious defect and in scoring should be cut in proportion to the seriousness of the thin condition.

The judging of dressed poultry requires much practice. In this respect it is much like all other types of judging. Score cards are probably more applicable to this type of judging than to the judging of production birds, but, nevertheless, much of the judging is done by the comparison method. The score card is worthwhile, however, because it gives a guide to the relative importance of various sections of the body when considered from the standpoint of meat production.

CHAPTER XVI

JUDGING EGGS

Eggs and meat are the final products from poultry. In the United States the value of eggs far exceeds that of poultry meat. According to statistics of the United States Department of Agriculture 23,619,000,000 eggs were produced in the United States in 1925. These eggs were produced under all kinds of conditions both as to feed and environment, and hence wide differences in quality are to be expected. The average consumer of farm products to-day is demanding a quality product, and among other things superior quality eggs.

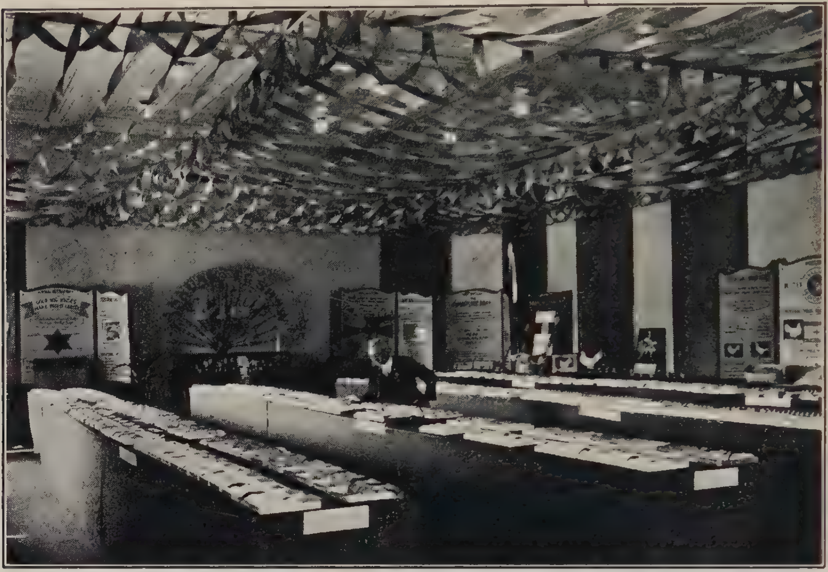
The demand for quality eggs, together with the fact that millions of eggs have been sold to the consumer in the past which were unfit for human food, has resulted in laws being passed to regulate the sale of eggs in many states. The Canadian government has passed laws governing the sale of eggs throughout the Dominion of Canada. A large amount of research work has been conducted by the United States government, state colleges of agriculture and state experiment stations in an effort to arrive at suitable standards of quality upon which definite grades may be based.

Eggs must be listed as a perishable product, even though under proper methods of handling and storing they may be kept for relatively long periods of time. Under improper conditions they deteriorate very rapidly in quality.

EGG SHOWS

Egg shows and demonstrations in the proper candling and judging of eggs have been the natural outlets to producers and consumers of the knowledge obtained through research as to the characters affecting the quality of eggs. Judging eggs by either the score card or comparison method is still a rather new feature of the fancy and commercial poultry industry as compared to the judging of poultry. Several colleges of agriculture have established egg shows, and many poultry shows have egg classes as an extra feature. Some states are combining the egg show with the baby chick show, the latter being a very recent development in the evolution of judging.

The Purdue Egg Show held annually at Purdue University, West Lafayette, Indiana, is known as the Pioneer Egg Show of America.



Courtesy Purdue University.

FIG. 159.—Judging Eggs at the 21st Purdue University Egg Show.

This is the pioneer egg show of America.

Courtesy Purdue University.

FIG. 160.—Most Exhibitors Like to Receive Some Recognition for Their Efforts.

At the Purdue show silver cups are given in each class for the best dozen eggs. Special prizes and ribbons are also offered.

The twenty-first Annual Exhibit was held in 1929. (Fig. 159.) The show is conducted by students in the Department of Poultry Husbandry. The object of the show, as stated in the annual catalog, is to encourage the production of more and better eggs and to give an instructive exhibition of the best methods of scoring, packing and grading eggs. Other important shows which have been established more recently are: the Ames Egg Show, held at Iowa State College, at Ames; the Annual Michigan Egg Show, held during Farmer's Week, at East Lansing, and the Pennsylvania Egg Show, held in connection with the Pennsylvania State Products Show, at Harrisburg.

QUALITY

Fig. 40 shows the reproductive organs of a laying hen and the development of an egg. The fact has been definitely established that distinct differences in quality may exist in eggs at the time they are laid. Fig. 41 shows the normal structure of an egg. Egg quality depends on both the exterior and interior condition of individual eggs.

EXTERIOR QUALITY

The exterior of eggs has an influence on their actual selling value, but not so much as their wholesomeness or the interior quality. In

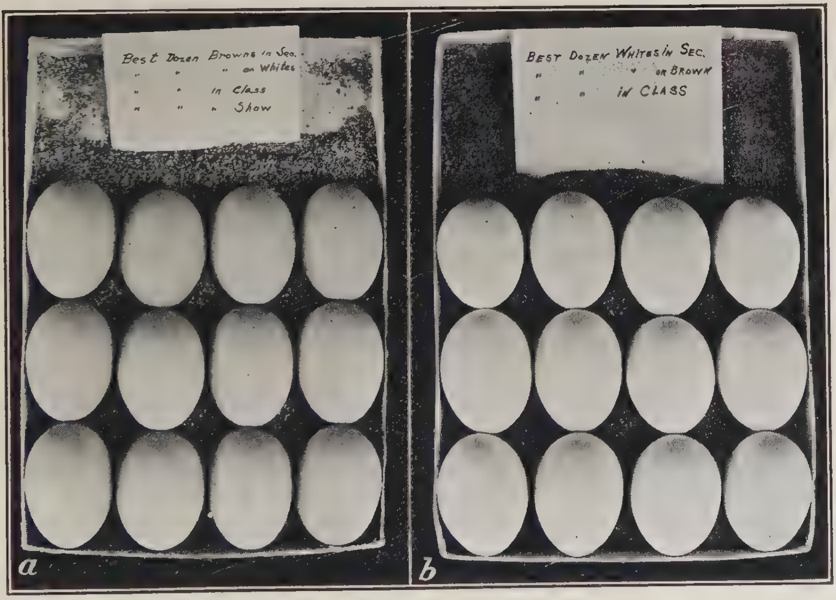


FIG. 161.—Best Dozen Brown Eggs in the 21st Purdue Egg Show on Left and Best Dozen White Eggs in Show on Right.

Note the method of displaying the eggs. These boxes are made of pasteboard 7 × 10 inches with an edge one inch high. Bran is placed in the box to hold the eggs in position.

certain types of judging only the exterior quality is considered. Points to consider relative to exterior are: color, size, shape, condition of shell and shell texture.

Small eggs or those not weighing two ounces are worth less than larger eggs, even if the interior quality is the same, because the actual amount of food is less. The misshapen egg is unattractive in appearance and may not fit well into an egg case. Round eggs and extra long eggs and those with irregular shells are considered to be poor in shape. All dirty or stained eggs should be given a cut in judging because such eggs may quickly deteriorate. Washed eggs do not keep well and buyers do not want them because they deteriorate quickly in storage.

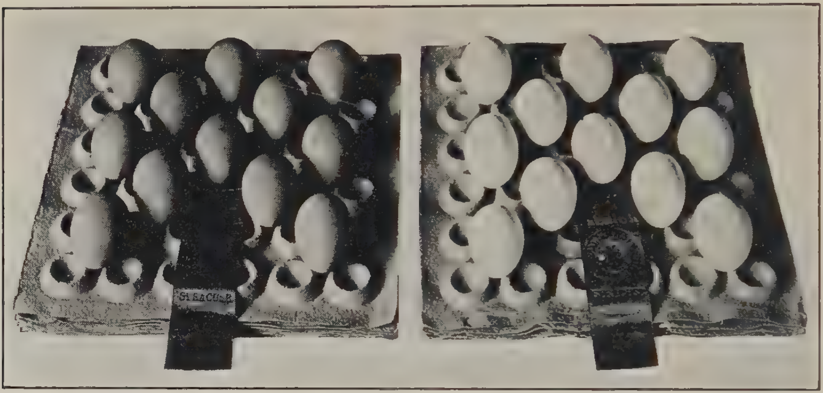


Fig. 162.—First Prize Dozen of Brown Eggs on Left and First Prize Dozen of White Eggs on Right at the New York State Fair.

Note method of displaying eggs.

Interior Quality

The real food value of an egg, if it is of proper size, is on the inside of the shell. Too often this is never known until the egg is placed upon the table. There are many different terms applied to the interior quality of eggs. Some of the more important ones are discussed.

(1) *Normal Fresh Egg.*—There is no shrinkage in such eggs and there is a general firm condition of white and yolk. When broken out the yolk is spherical and firm.

(2) *Stale Egg.*—The air cell is enlarged. The contrast between white and yolk is increased as compared to a fresh egg. When broken

out the white is very thin and watery and the yolk distinctly flattened.

(3) *Weak Egg.*—The air cell is much enlarged with the lower wall usually movable in outline, with a weak condition of white and yolk. The yolk-sac often breaks when the egg is opened.

(4) *Egg with Movable Air Cell.*—The air cell always remains at the highest point of the egg. May be found in a fresh, stale or weak egg.

(5) *Spots or Spot Rots.*—If an egg is fertile and the temperature is above 70 degrees, the embryo will start development. The higher the temperature the faster it grows. When life commences, blood vessels grow around the yolk of the egg, radiating from the germ. If life ceases, the germ may show as a spot on the yolk of the egg, either large or small in size.

(6) *Blood Rings.*—Such eggs are germinated fertile eggs, not only showing spots but also the blood vessels which have collected into a blood ring. Such eggs are unfit for human food.

(7) *Mixed Rot.*—The yolk-sac is broken and the entire contents of the egg presents a streaked appearance due to the mixing of the white and yolk.

(8) *Black Rot.*—The contents of the egg is generally gray or black in color. When broken out there may be a decomposed embryo present. Offensive odors are nearly always present in such eggs.

(9) *White Rot.*—Such an egg contains a more or less uniform mixture of white and yolk with a stale or sour odor.

(10) *Moldy Eggs.*—Black patches of mold growth are present. Other types of eggs are: double yolk; egg with bloody white; egg containing blood clots or other foreign bodies; egg with heavily stuck yolk; musty egg; sour egg; egg with green white; egg with heavily mottled yolk; and egg with crusted yolk.*

SCORE CARD JUDGING

Eggs are judged almost entirely by the score card method. The following is the score card used at the Purdue Egg Show in the fancy classes.

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*For a detailed description of interior egg quality the reader is referred to Marketing Poultry Products, by Benjamin, John Wiley and Sons, New York City.

EXHIBITION EGG SCORE CARD

Points Considered

Points		Cut	Defects	Number of Defects
20	Size		Too small—too large	
10	Uniformity of Size	....	Eggs not all same size in dozen	
5	Shape	....	Too round—too pointed	
10	Uniformity of Shape	....	Eggs not all same shape in dozen	
10	Color	....	Not pure white—too light, too dark	
10	Uniformity of color	....	Eggs not all same color in dozen	
25	Shell texture	....	Porous—ridges—wrinkles—weak tips	
10	Condition of shell	....	No bloom — dirty and stained — cracked	
	Disqualifications	....	Reasons	
100	Totals			

Explanation of Fancy Egg Score Card

Size.—Eggs of all breeds must weight 24–30 ounces. Two points will be cut for each ounce over and three points for each ounce under weight. These weights are the commercial and also the normal weights for the fancy breeds. Eggs over 30 ounces cannot be shipped in ordinary egg-case fillers and eggs under 24 ounces must go as second grade eggs. *Weight is very important for score is controlled partly by size.*

Uniformity of Size.—Uniformity largely controls appearance. All eggs should be the same size, as small or large eggs are not classed as first grade.

Shape.—Five points are allowed if all eggs are perfect in shape.

Uniformity of Shape.—All eggs should be uniform in shape.

Color.—If eggs are white they should be pure-white and if brown they may be of any shade, but should be uniform.

Shell Texture.—Free from wrinkles, rough places, but more especially weak spots, blind checks and other blemishes. Eggs should not be cracked. *One cracked egg will disqualify the dozen.*

Condition of Shell.—Free from dirt and stain and unwashed. No eggs will be considered which are unfit for human consumption.

This score card is based on exterior quality so that all the judging may be done without the use of a candler, or device used to examine the interior contents of an egg.

The commercial score card used in judging eggs at the Purdue Egg Show is as follows:

COMMERCIAL SCORE CARD

Points Considered

Size	25
Shape	3
Uniformity of size and shape	5
Uniformity of color	4
Shell Texture	5
Condition of Shell	8
Quality (by testing)	
(a) Size of air cell	25
(b) Opaqueness	25

Explanation of the Commercial Egg Score Card

Size.—Extras—26–30 ounces. Firsts 24–26 ounces. One point cut for each ounce over or under required weight in either class.

Shape.—One-fourth point allowed for each egg.

Uniformity of Size and Shape.—All eggs should be the same size and shape.

Uniformity of Color.—If white, eggs should be all pure white and same shade. If brown, the color may be any shade, but the dozen should be uniformly the same. One-third point allowed for each egg.

Shell Texture.—Free from wrinkles, spots, cracks and rough places, five-twelfths point for each egg.

Condition of Shell.—Free from dirt or stain, unwashed, two-thirds point for each egg.

Quality.—Test with candler. (a) Air cell very small, about the size of a dime, indicating freshness. (b) Egg must appear opaque the yolk free from dark color, albumen thick, yolk barely visible. Large air cells, floating yolks or air cells are defects. Eggs must be fresh and sweet.

Disqualifications.—Cracked, broken spots, musty rots, and germ or blood rings, in any one, will disqualify the dozen.

In the commercial score card it will be seen that 50 points out of 100 are allowed for interior quality and that 25 of the remaining points are given to size. These factors may be considered most important from the standpoint of the buying public.

The following is a score card for judging exterior quality of eggs used by the Poultry Department at Cornell University.

SCORE CARD FOR JUDGING EXTERIOR QUALITY OF EGGS

Variety__________ Date__________

Entry No. __________ Weight__________

	Perfect Score Per Dozen	Perfect Score Per Egg	Cuts	Number Cuts Disqualifies, Dozen	Total Score
Size (weight).............	24	2	......	16	
Uniformity of size (weight).	12	1	......	8	
Uniformity of shape........	16	$1\frac{1}{3}$	......	11	
Color and condition........	24	2	......	16	
Shell Texture.............	24	2	......	16	
Total...............	100	$8\frac{1}{3}$	......	67	

Exhibitor__________ Judge__________

Anyone of the following disqualifies the dozen:

1. Double yolked eggs.
2. Checked eggs.
3. Egg unfit for food.

Eggs that are breakable owing to shape when in ordinary thirty dozen case. (Serious Defect.)

EXPLANATION OF SCORE CARD POINTS

From a breeder's point of view, size, shape, color and shell texture are all important. It may be also that the contents of the egg should

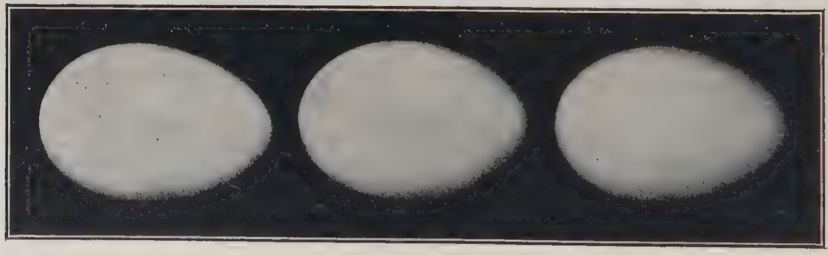

Fig. 163.—A Trio of White Eggs with Ideal Shape and Excellent Shell Texture.

be scored, but with our present knowledge we only know that the characteristics of the shell are transmitted.

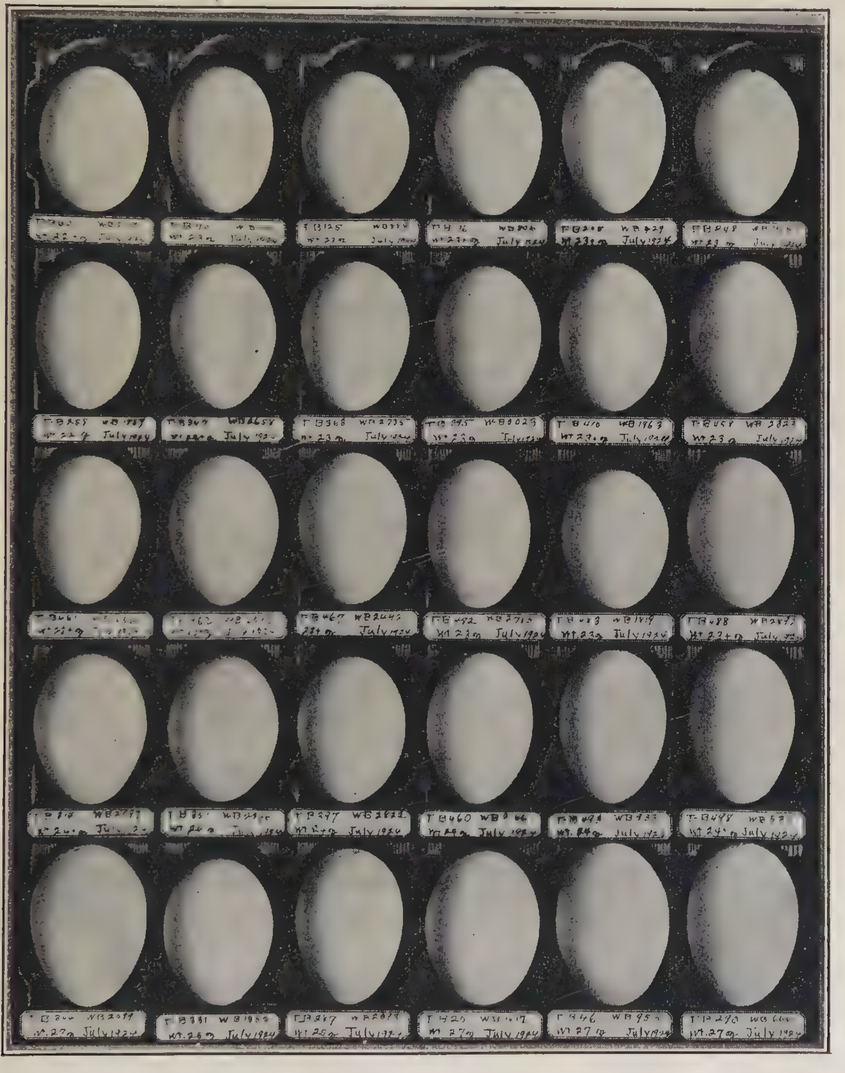

FIG. 164.—The Eggs from 30 Different Hens of the Same Strain, Showing Some Variation in Size but Remarkable Uniformity in Shape and Color.

In selecting eggs, we are, of course, keeping in mind the production of an egg that will best meet the consumer's demand.

Score Card for Judging Interior Quality of Individual Eggs by Candling
(Cornell University)

Character[1]	1	2	3	4	5	6	7
Depth of Air Cell	Less than $\frac{1}{8}$	$\frac{1}{8}$-$\frac{2}{8}$	$\frac{2}{8}$-$\frac{3}{8}$	$\frac{3}{8}$-$\frac{4}{8}$	$\frac{4}{8}$-$\frac{5}{8}$	$\frac{5}{8}$	
Condition of Air Cell	Localized, regular, clear	Localized, regular, dark ring	Localized, irregular	Localized, very irregular, tremulous	Localized, very irregular, tremulous, freely movable	Loose air cell	
Appearance of Yolk	Dimly visible	Visible	Visible, mobile	Plainly visible, freely mobile	Albumen stick to membrane	Yolk stick to membrane	Mixed egg
Appearance of Albumen	Firm, clear	Reasonably firm	Slightly thin	Medium watery	Decidedly watery	Cloudy	Rotten

[1] An egg scoring 1 for each character would be of the best quality. An egg scoring 6 for each character would be of very poor quality.

Size.—Each entry should weigh 25 ounces or over. Cut 4 (per dozen) for each ounce or part of an ounce under weight.

Uniformity of Size.—The attractiveness of the dozen is largely dependent upon uniformity and has a direct influence on market value.

Uniformity of Shape.—This differs from uniformity of size in that size is the volume represented in weight, while shape has to do with the outline of the egg. Uniformity of shape has a very great influence on the appearance.

Color.—In judging white eggs, all tinted eggs should be cut. Color has an influence on the market price; is transmitted, and should, therefore, be avoided in breeding stock. In judging brown eggs the number of points should be divided as follows:

Condition............	12
Uniformity of color....	12

Condition refers to cleanliness and general appearance.

Shell Texture.—On account of shipping and appearance, all shells should be of fine texture, strong, free from wrinkles, rough places, thin and porous spots.

A second score card used for judging interior quality of individual eggs by candling is used at Cornell University.

Other score cards are used at different agricultural colleges and at the egg shows held at Ames, Iowa, Harrisburg, Pennsylvania, Manhattan, Kansas and East Lansing, Michigan. These do not differ materially from the score cards used at Purdue and Cornell.

STANDARDIZATION OF EGGS

One of the most important steps in the standardization of eggs was the formation of the United States Standards of Quality for Individual Eggs as established by the United States Department of Agriculture. These standards are shown in Table 30 which follows. The classification of individual eggs according to these standards is effected through examination of the shell of the egg to determine its exterior quality, and by the process known as candling to determine its interior quality.

RETAIL GRADES OF EGGS

Many states have established retail egg grades based on the United States Standards for Individual Eggs. Laws have been passed making it mandatory that eggs shall be sold under the approved grades. The New York State Egg Law may be cited as an example. The grades established by this law are given in Table 31.

TABLE 30

U. S. STANDARDS OF QUALITY FOR INDIVIDUAL EGGS

Quality Factors	U. S. Special	U. S. Extra	U. S. Standard	U. S. Trade	U. S. Standard Dirty	U. S. Trade Dirty	U. S. Check or Crack
Shell	Clean, sound	Clean, sound	Clean, sound	Clean, sound	Stained or dirty but sound	Stained or dirty but sound	Clean or dirty; cracked but not leaking
Air cell	$\frac{1}{8}$ in. or less, localized; regular	$\frac{2}{8}$ in. or less, localized; regular	$\frac{2}{8}$ in. or less, localized; may be slightly tremulous	May be over $\frac{3}{8}$ in., may be bubbly or freely mobile	$\frac{3}{8}$ in. or less; localized; may be slightly tremulous	May be over $\frac{3}{8}$ in. May be bubbly or freely mobile	May be over $\frac{3}{8}$ in. May be bubbly or freely mobile
Yolk	May be dimly visible	May be visible	May be visible; mobile	May be plainly visible; dark in color; freely mobile	May be visible; mobile	May be plainly visible; dark in color; freely mobile	May be plainly visible; dark in color; freely mobile
White	Firm, clear	Firm, clear	Reasonably firm	May be weak and watery	Reasonably firm	May be weak and watery	May be weak and watery
Germ	No visible development	No visible development	Development may be slightly visible	Development may be clearly visible but no blood showing	Development may be slightly visible	Development may be clearly visible but no blood showing	Development may be clearly visible but no blood showing

TABLE 31

THE NEW YORK RETAIL EGG GRADES ARE BASED UPON THE U. S. STANDARDS OF QUALITY FOR INDIVIDUAL EGGS FORMULATED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE

The following table gives such U. S. standards and shows the relationship between the New York retail egg grades and the U. S. Standards of quality for individual eggs.

Grade Factors	Minimum Requirements			
	Fancy Grade same as U. S. Special [1]	Grade A same as U. S. Extra [1]	Grade B same as U. S. Standards [1]	Grade C [2]
Shell	Clean, sound	Clean, sound	Clean, sound	Clean or dirty; cracked but not leaking
Air cell	$\frac{1}{8}$ in. or less, localized; regular	$\frac{2}{8}$ in. or less, localized; regular	$\frac{3}{8}$ in. or less, localized; may be slightly tremulous	May be over $\frac{3}{8}$ in. May be bubbly or freely mobile
Yolk	May be dimly visible	May be visible	May be plainly visible; mobile	May be plainly visible; dark in color; freely mobile
White	Firm, clear	Firm, clear	Reasonably firm	May be weak and watery
Germ	No visible development	No visible development	Development may be slightly visible	Development may be clearly visible but no blood showing

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[1] U. S. Standards of Quality for Individual Eggs.

[2] Includes U. S. Trades, U. S. Standard Dirties, U. S. Trade Dirties and U. S. Checks (U. S. Standards of Quality for Individual Eggs.)

EXPLANATIONS AND DEFINITIONS OF TERMS USED IN CONNECTION WITH THE UNITED STATES STANDARDS OF QUALITY

(As given in Egg Standardization Leaflet No. 2 issued by the United States Department of Agriculture, Revised May, 1929)

TERMS DESCRIPTIVE OF THE AIR-CELL

Localized.—A localized air-cell is one which retains a fixed position when the egg is twirled before the candle.

Regular.—A regular air-cell is one which shows a practically even smooth outline when the egg is twirled, without any movement from its normal shape and position in the egg.

Slightly Tremulous.—A slightly tremulous air-cell is one which retains a practically fixed position in the egg, but shows a slight movement at one or more points where its lower edge touches the shell.

Bubbly.—A bubbly air-cell is one which has several rather small air bubbles within it which give it a bubbly appearance.

Freely Mobile.—A freely mobile air-cell is one which moves freely about in the egg when it is turned.

A freely mobile air-cell which readily moves to the uppermost point of the egg as it is turned, indicates that the inner shell membrane is ruptured or broken.

TERMS DESCRIPTIVE OF THE CONDITION OF THE SHELL

Clean.—A clean shell is one which is free from foreign matter and from stains or discolorations. Processed eggs which show traces of the processing oil on the shell are considered clean unless the shell is otherwise soiled.

Stained.—A stained shell is one which has been discolored by contact with foreign substances, such as wet straw, damp earth, etc.

Dirty.—A dirty shell is one which has adhering to it particles of soil, foreign matter, masses of egg yolk, etc.

Practically Clean or Slightly Dirty.—A practically clean or slightly dirty shell is one which is stained or soiled to such a slight extent that it is not particularly noticeable.

Checked or Cracked.—A checked or cracked shell is one which is fractured but has an intact shell membrane which prevents the contents from leaking out.

Leaker.—A leaker is an egg with a cracked shell and a broken shell membrane which permits the contents to exude or leak out.

Blind Check.—A blind check is a cracked egg in which the crack in the shell is so fine that it is not readily discernible to the naked eye except before the candle.

Body Check.—A body check is a healed over crack in the shell that occurred prior to the time the egg was laid by the hen.

Sound.—A sound shell is one that is free from actual checks and cracks.

TERMS DESCRIPTIVE OF THE CONDITION OF THE YOLK

Dimly Visible.—A dimly visible yolk is one which can be distinguished before the candle as a shadowy object without clear distinction of outline and which does not move far from its normal position in the center when the egg is twirled.

Visible.—A visible yolk is one which has a fairly definitely discernible outline before the candle and which moves somewhat from the center of the egg when it is twirled.

Plainly Visible.—A plainly visible yolk is one which has a plainly discernible outline before the candle but not dark in color and which moves freely from the center of the egg when twirled.

Mobile.—A mobile yolk is one which shows considerable movement away from the center of the egg when it is twirled before the candle.

Freely Mobile.—A freely mobile yolk is one which shows a wide movement or swing away from the center of the egg when it is twirled before the candle and comes sufficiently close to the shell to appear decidedly dark in color.

Dark Color.—A dark color yolk is one which because of its freely mobile condition closely approaches the shell when twirled before the candle and is distinctly discernible as dark in color.

TERMS DESCRIPTIVE OF THE CONDITION OF THE WHITE

Firm White.—A firm white is one which is sufficiently thick or viscous to permit but little movement of the yolk from the center of the egg. A firm white is one of the principal causes of a dimly visible yolk.

Reasonably Firm White.—A reasonably firm white is one which has a weakened viscous condition and thereby allows the yolk to move more freely from its normal position in the center of the egg and to approach more closely the shell when the egg is twirled. When the white is reasonably firm, the outline of the yolk becomes fairly distinct, but the yolk does not approach the shell closely enough to appear dark in color.

Weak and Watery.—A weak and watery white is one which is thin and generally lacking in viscosity and therefore permits the yolk to move freely from its normal position in the center of the egg and closely approach the shell when the egg is twirled. A weak and watery white is indicated by the free movement of the yolk and by the decidedly dark color of it as the egg is twirled before the candle. Eggs with weak and watery whites often develop a tremulous, bubbly or freely mobile air-cell.

Clear White.—A clear white is one which is free from any foreign bodies floating in it which in candling would appear as dark irregular spots which are often called " meat spots." A thick fibrous chalaza may appear rather prominently in the white and be mistaken for " meat spots." Such condition of the white, however, would be considered as clear.

Terms Descriptive of the Germ

No Visible Development.—No visible development of the germ indicates that there has been no development of the germ spot or if slight development has occurred that it has not proceeded to the point where it can be distinguished by candling.

Slightly Visible Development.—Slightly visible development of the germ indicates that there has been some development of the germ and that it has proceeded to the point where it is indistinctly visible as a deeper colored area on the yolk.

Clearly Visible Development.—Clearly visible development of the germ without blood showing, is a condition that indicates that the development of the germ has progressed to a point where it is plainly visible as a deeper colored area on the yolk.

Inedible Eggs or Loss

Inedible Egg.—An inedible egg is one which is unwholesome or otherwise unfit for food.

Loss.—The term loss as generally used includes all inedible eggs, and those that have been smashed and therefore are of no commercial value.

Inedible Eggs that May be Detected by Candling

Black Rot.—A black rot is a decomposed egg the contents of which are gray or black in color when seen before the candle.

Mixed Rot.—A mixed rot is an egg in which the yolk is broken and is partially mixed with the white.

Blood Ring.—A blood ring is an egg in which germ development has taken place to the point that blood veins have formed around it giving a reddish glow and visible presence of blood veins.

Seeping Yolk.—An egg with seeping yolk is one in which the yolk sac is broken and part of the yolk is seeping through into the white.

Large embryo.—An egg with a large embryo is one in which there is a network of blood vessels on the yolk in the center of which is a dark body, the embryo, of varying size depending on the degree of development of the germ.

Bloody White.—An egg with a bloody white is one which has a general reddish appearance due to blood mixed through it and which may show spots of blood floating in the white.

Moldy Egg.—A moldy egg is one which has developed moldy spots within the egg shell or along cracks in the shell which appear as grayish or black areas. Advanced stages of mold development may cause the entire egg to appear black before the candle.

Crusted Yolk.—A crusted yolk is one which is covered with a light color crust which has a tendency to flake off and in which the white is watery and frequently yellowish in color and possessing a putrid odor. Before the candle it also may show dark spots on its surface.

Stuck-yolk.—A stuck-yolk is one which has adhered to the shell and maintains a fixed position at that point. Eggs with the stuck-yolks are considered inedible.

Foreign Material in Eggs Which May be Detected by Candling

Blood Clots and " Meat Spots."—Small clots of blood on the surface of the yolk or floating in the white are usually detectable by candling and if not mixed with the white do not render the egg inedible. Small particles of foreign material such as pieces of tissue, known as " meat spots," are also detectable by candling but do not render the egg inedible. Eggs containing small blood clots or " meat spots " should not be graded higher than U. S. Trades.

Inedible Eggs Which Cannot be Detected by Candling

Green White.—An egg with a green white can be detected with certainty only on breaking the shell, when the white shows a distinct greenish white color.

Musty Egg.—A musty egg is one which has a stale musty odor.

Sour Egg.—A sour egg is one which has a sharp sour odor.

Unusual Edible Eggs

Grass Egg.—A "grass" egg is an egg with an olive-colored yolk giving a greenish cast to the whole egg which deepens in the region of the yolk. It may be caused by the hens eating shepherd's purse and other weeds of the same family.

NEW YORK RETAIL EGG GRADES

The several grades and standards of quality hereinafter set forth are hereby established pursuant to section 160*b* of the Agriculture and Markets Law, applying to the sale of eggs in New York State to consumers, and shall be known as New York Retail Egg Grades.

Retail Grades

Standards of Quality

All eggs unbroken and in the shell, when sold or exposed for sale to consumers for human consumption, shall be sold or exposed for sale on the basis of the following grades, the minimum requirements of which are:

Fancy Grade.—Eggs uniform in size; shell clean and sound; air-cell $\frac{1}{8}$-inch in depth or less, localized and regular; yolk not more than dimly visible; white firm and clear; no visible development of the germ. (Individual eggs of the quality of U. S. Special meet this grade.)

(*Explanatory Note:* This is a grade for eggs of exceptional quality, never on the market except in limited quantities.)

Grade A.—Eggs uniform in size; shell clean and sound; air-cell $\frac{2}{8}$-inch in depth or less, localized and regular; yolk may be visible; white firm and clear; no visible development of the germ. (Individual eggs of the quality of U. S. Extras meet this grade.)

Grade B.—Eggs uniform in size; shell clean and sound; air-cell $\frac{3}{8}$-inch in depth or less, localized, may be slightly tremulous; yolk may be mobile and plainly visible; white reasonably firm, germ development may be slightly visible. (Individual eggs of the quality of U. S. Standards meet this grade.)

Grade C.—Eggs which have been candled and found edible but not meeting the requirements for Fancy Grade, Grade A, or Grade B, or edible eggs which have not been candled. (Individual eggs of the quality of U. S. Trades, U. S. Standard Dirties, U. S. Trade Dirties, and U. S. Checks or Cracks meet this grade.)

(The foregoing grades and standards are based on the U. S. Standards of Quality for Individual Eggs, formulated by the U. S. Department of Agriculture.)

Candling

Classification of Individual Eggs. In the grading of any lot of eggs, classification shall be effected through visual examination of the shell to determine its cleanliness and by the process known as " candling " to determine size and condition of the air-cell and the condition of the yolk, white and germ, and condition and soundness of the shell.

Tolerances

On account of unavoidable changes in eggs after candling and before reaching the consumer, the following tolerances are hereby established for Fancy Grade, Grade A and Grade B:

Not more than two eggs per dozen may be below the requirements for the designated grade, providing such eggs meet the requirements for the next lower grade.

Standards of Quality of Fresh Eggs

Fresh Eggs.—The term " fresh " may be applied, in addition to the grade designation, to any lot of Fancy Grade or Grade A eggs which are free from objectionable odor and flavor and not over thirty days old; but neither the term " fresh " nor any term of similar import may be applied in a brand name, or otherwise, either by direct statement or implication, to any lot of eggs which are below the requirements for Grade A or which are more than thirty days old.

Shell Treated Eggs.—Eggs preserved or protected by treating the shell with oil or any other substance may be sold under any of the various grades applicable thereto as above provided; but if offered for sale or sold as " fresh " or by any term or description of similar import, they must be designated as " Shell Treated " in addition to the grade designation.

RULES AND REGULATIONS

The following rules and regulations are hereby established under the authority of section 160*b* of the Agriculture and Markets Law:

Eggs Unfit for Human Food; Inedible Eggs

Rule 1.—An egg whose interior quality is below the minimum requirements for U. S. Trades (U. S. Standards of Quality for Individual Eggs) shall be deemed to be inedible and unfit for human food.

An egg containing a small clot of blood on the surface of the yolk or floating in the white (if not mixed with the white) shall not on that account be deemed to be inedible.

An egg containing small particles of foreign material, such as pieces of tissue known as " meat spots " shall not on that account be deemed to be inedible.

An egg containing a small clot of blood, as above described, or small particles of foreign material, such as pieces of tissue known as " meat spots " shall not be included in any lot of eggs sold under the designations: Fancy Grade, Grade A or Grade B; and not more than two of such eggs shall be included in any dozen of eggs sold under the designation Grade C.

Other types of foreign material within the egg contents shall be deemed to render the egg inedible.

An inedible egg shall be deemed to be unfit for human food and shall not be sold, offered for sale or exposed for sale for human food.

Sale of Eggs to Retailers

Rule 2.—For the purpose of these regulations, a retailer shall be deemed to be any person, firm or corporation buying eggs for the purpose of resale to consumers.

Rule 3.—Any person selling eggs other than those of his own production to a retailer shall furnish to the retailer an invoice prior to or accompanying the delivery of the eggs, specifying the grade according to the New York Retail Egg Grades. If the eggs have not been candled by the seller the invoice, in lieu of grade designation, may substitute this legend: " Notice. These eggs have not been candled. Before resale they must either be candled and graded or sold under the designation Grade C." The invoice shall in addition, designate the eggs as " cold storage " or " refrigerator," if the eggs have been in cold storage for more than thirty days, either within or without the state.

Rule 4.—Each lot of eggs covered by an invoice must be listed separately and the grade stated.

Advertising

Rule 5.—Any advertisement of eggs for sale at a given price shall plainly and conspicuously indicate the grade.

Sale of Eggs to .Consumers

Rule 6.—Any person exposing for sale or offering for sale to a consumer eggs other than those of his own production shall give notice of the exact grade of the eggs in the following manner:

If the eggs are offered for sale in cartons, by plainly and conspicuously printing or writing on each carton the exact grade.

If the eggs are offered or displayed for sale in bulk, by plainly and conspicuously indicating the exact grade by a placard exhibited among or closely adjacent to the eggs.

Rule 7.—Any person selling to a consumer eggs other than those of his own production shall give notice as to the exact grade of the eggs by plainly and conspicuously printing or writing the grade on the carton, bag or other container in which the eggs are delivered to the purchaser.

Rule 8.—The marking of the grade upon any placard as to eggs offered or displayed for sale in bulk, or upon any carton, bag or other container in which eggs are exposed for sale or delivered to the purchaser, shall be in legible printing or writing in letters not less than $\frac{3}{8}$-inch in height, and the grade designation shall not be abbreviated.

Rule 9.—The use of the term " fresh " or any other term of similar import shall not be deemed to be a substitute for grade designation.

WEIGHT AND SIZE

Rule 10.—The term " large " or any term of similar import shall not be applied to any lot of eggs in connection with a sale, offering for sale or advertisement for sale, unless the eggs weigh at the rate of not less than 24 ounces per dozen.

Rule 11.—The term " medium size " or any term of similar import shall not be applied to any lot of eggs in connection with a sale, offering for sale, or advertisement for sale, unless the eggs weigh at the rate of not less than 20½ ounces per dozen.

Rule 12.—The term " small " or other term of similar import *must* be applied to any lot of eggs in connection with a sale, offering for sale, or advertisement for sale, if the eggs weigh at the rate of less than 20½ ounces per dozen.

INTERPRETATION OF TERMS USED

Rule 13.—In interpreting the terms used in the New York Retail Egg Grades, in regard to the depth and character of the air-cell, condition of yolk, condition of white, appearance of germ and condition of the shell, and in regard to inedible eggs, the definitions and explanations formulated by the U. S. Department of Agriculture and contained in U. S. Egg Standardization Leaflet No. 2, as revised May, 1929, shall apply.

Rule 14.—" Candling " shall be understood to mean the common practice of examining the interior of an egg by holding and twirling the same before a bright light passing through an aperture in an opaque shield.

Rule 15.—" Uniform in size " shall be understood to mean eggs which appear to the eye to possess such uniformity, but no lot of eggs shall be deemed to be uniform in size which has a maximum variation in weight, as between individual eggs, in excess of $\frac{2}{8}$ ounce.

The foregoing retail grades and rules and regulations are to take effect August 5, 1929, and on that day are to supersede the retail grades and standards for eggs and rules and regulations established August 19, 1927.

BERNE A. PYRKE,
Commissioner of Agriculture and Markets.

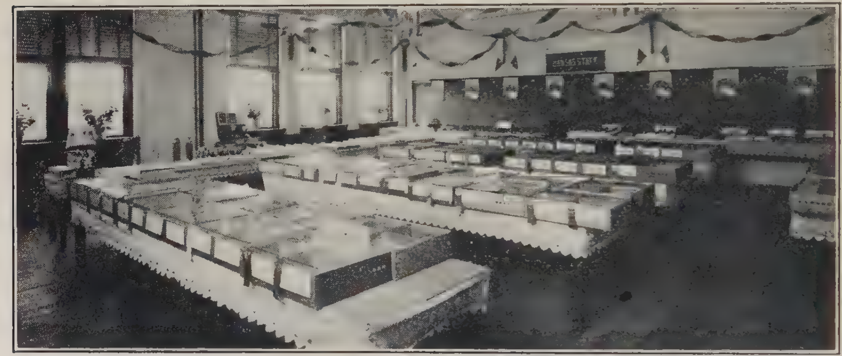
Dated, Albany, N. Y., June 13, 1929.

In order to enforce such a law it is necessary to have well-trained inspectors and candlers. In order to assist in this work the Poultry Department at the New York State College of Agriculture has established an egg-grading school for inspectors. Those persons making satisfactory progress during the school are awarded certificates. Poultrymen or egg dealers may take the work in the egg-grading school. Through the cooperation of the producer, the egg dealer and the inspection service, the consumer should be able to buy the quality of egg desired and get what he pays for.

CHAPTER XVII

JUDGING BABY CHICKS

IN 1926 the Poultry Department of the Kansas State Agricultural College introduced a new feature in the field of judging poultry. This new idea was the Baby Chick Show and a method of judging baby chicks. Other states have followed the lead set by Kansas. It will have a far-reaching effect in improving the quality of baby chicks. The effect will be in two directions. The hatcherymen, as a result of their entering into competition with other hatcherymen from their own and neighboring states, will have a better appreciation of the actual differences in quality of chicks, and hence will strive to produce a superior quality. The buying public will learn to appreciate the comparative quality of chicks and as a result of this newly acquired knowledge will demand better quality when buying chicks.



Courtesy Kansas Agricultural College.

FIG. 165.—A Baby Chick Show.

Regular chick shipping boxes covered with glass are very satisfactory for displaying baby chicks.

The year following the baby chick show at Kansas one was held at Iowa. In the next year or two Michigan, Ohio, Oklahoma, New Jersey and California organized similar shows. Many other states are considering this type of show, especially those states having large hatchery interests. New York and Pennsylvania organized shows in 1930.

In order that visitors of the show may see each entry a glass cover for the container is essential while the chicks are in the showroom. (Fig. 165.) "Live and grow" brooders are often used for this purpose. Entries are usually 25 or 50 chicks each. An age limit of 24 hours is usually placed on all chicks entered for competition.

ARRANGEMENT OF CLASSES

There are many different methods of dividing the entries in order to group them into classes for the purpose of judging. The classification used will vary in different states depending on the relative importance of various breeds and systems of breed improvement. The first classification should be made on the basis of breed. It is just as difficult to judge different breeds of baby chicks together in one class as it is to judge different breeds of adult fowls together in one class. Classes of at least White Leghorns, Rhode Island Reds, Barred Plymouth Rocks and White Wyandottes should be made. One open class for entries of miscellaneous varieties and breeds should be planned. If any breed other than the four mentioned above is of sufficient importance in a particular locality to attract enough entries to provide proper competition, provision should be made to handle the breed as a separate class. In states having well organized breed improvement programs in operation the White Leghorn class in particular, and often some of the other classes, may be divided so that chicks of "Record of Performance" grade can be judged separately from the "Certified,"

TABLE 32

A COMPARISON OF SEVERAL BABY CHICK SCORE CARDS

	Kansas, Points	Michigan, Points	New York, Points
Vigor	30	20	25
Condition	30	15	30
Uniformity of color	20	15	15
Uniformity of size	10	15	15
Weight	10	15	15
Type	..	10	
Color	..	10	
Total	100	100	100

"Supervised" or "Accredited" grades. At the present time all judging of baby chicks is done by the score card method. As in case of score cards for production judging, we find many different types of score cards in use for baby chicks. They usually include about the same points and probably arrive at practically the same conclusion when applied to different classes of chicks. For purpose of comparison several different types of score cards are shown in Table 32.

SCORE CARDS

Vigor.—In all cases vigor very properly is given the greatest consideration. Vigor can be determined by the alert, lively activity of the chicks in the different entries. Any evidence of chicks that do not show the desired activity warrants a cut on this section. The score card of the Kansas State Agricultural College provides for a cut of ½ to 1 point for each chick not showing the maximum of alertness upon arrival.

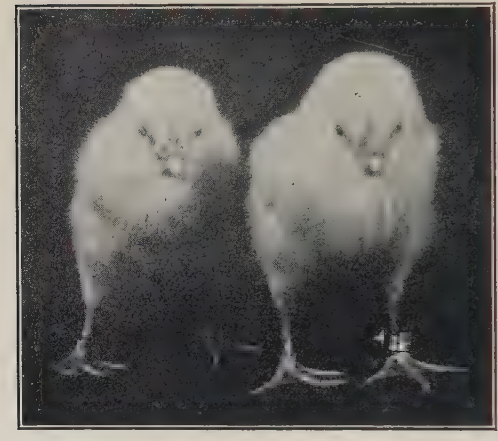


Fig. 166.—Crooked Toes, a Defect Common in Baby Chicks.

Condition.—Condition is given about the same consideration as vigor. There are many points that may be considered with respect to this character; such as deformities, imperfectly healed navels, pasty vents, brightness and prominence of the eye, hardness of body, carriage of wing, voice, etc. Imperfectly healed navels should be cut ½ to 2 points. Deformities should be cut from 1 to 2 points depending upon the seriousness of the defect. Fig. 166 shows two examples of crooked toes. Pasty vents are also considered under "condition"; also any evidences of sticky

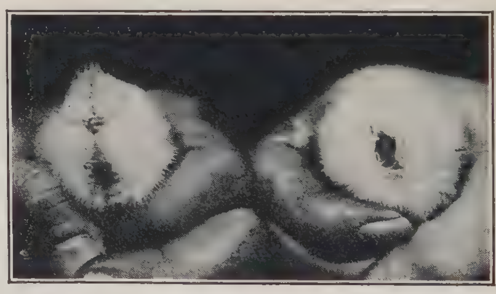


Fig. 167.—The Chick on the Left Has an Improperly Healed Navel.

Note the dark portion of yolk protruding. The chick on the right shows a properly healed navel.

hatches. From ½ to 1 point is deducted for the pasty vent and ¼ to 1 point for evidence of a sticky hatch. Fig. 167 shows a comparison of an imperfectly and a perfectly healed navel. All of these cuts are made on each chick showing the imperfection. These defects are usually the result of poor or improper hatching. Delayed hatches due to the eggs being incubated under improper conditions of temperature, ventilation or humidity will usually produce chicks that show these imperfections. They are serious because the chicks showing the defects usually are the type that help to increase the mortality in the first few days of rearing.

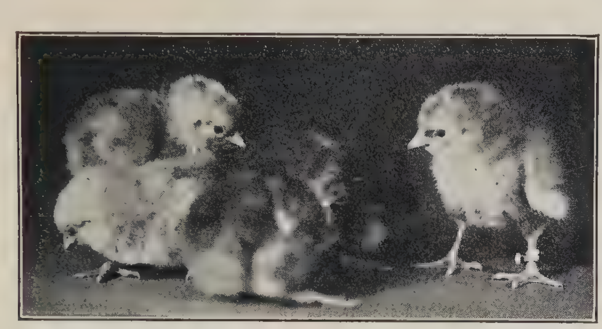


Fig. 168.—Rhode Island Red Chicks often Show Variation in Color, from Light to Medium or Dark Shades of Red.

The dark red color is the most desirable.

Uniformity of Color.—Uniformity of color is next in importance. This factor is given from 15 to 20 points out of the 100 points allowed for each entry. A cut of ¼ point is allowed for each chick whose down color varies from the average of the entry, while ¼ point is cut for each chick having leg color other than standard for the breed and variety. Fig. 168 shows great variation in down color of Rhode Island Red chicks. One of the most difficult tasks of the judge often is the scoring of an entry on color or uniformity of the color. The Michigan score card allows 10 points for *actual* color in addition to the *uniformity* of

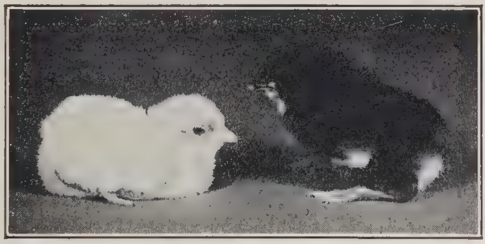


Fig. 169.—Nature Exhibits Some Very Interesting Traits.

These chicks came from eggs laid by a single hen mated to but one male. The parents were both blue. From such birds, on the average, one chick will develop into a splashed white bird, one into a black bird and two into blue birds like their parents. When the white birds are mated to black birds all of their chicks are blue. The parents of these chicks were Blue Andalusians.

color. This is an excellent idea but a difficult one to apply because few are sufficiently experienced to differentiate between the various down colors of all of the breeds and select the exact shade of color

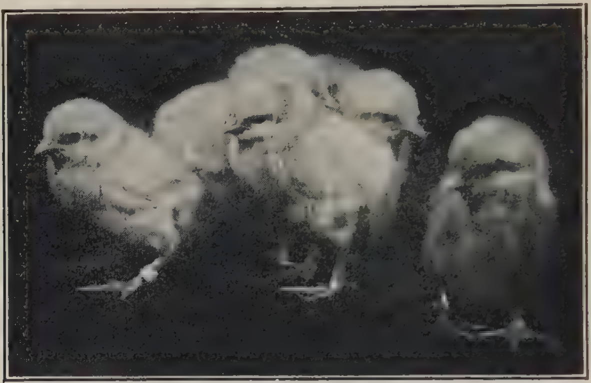


Fig. 170.—Single Comb White Leghorn Baby Chicks of Excellent Quality.

desired for each of the many breeds and color patterns. This might be particularly true with Blue Andalusians. (Fig. 169.)

Down Color Patterns.—The desired down color for the most important color patterns, according to Punnett, is as follows:

White.—The down of white breeds should be a pale yellowish cream.

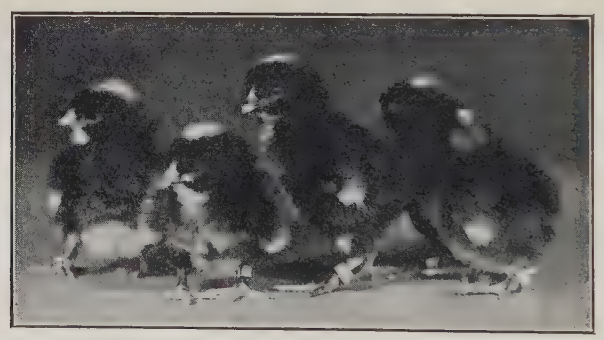


Fig. 171.—Barred Plymouth Chicks Showing Excellent Color Markings.

Note the light colored fluff, throat, tips of wings and top of head. The back color is black.

(Fig. 170.) Occasional black ticks are found and these usually develop into ticked feathers. Black spots or tinges of buff or red are disqualifications in case of White Leghorn chicks shown in the Iowa show. The absence of the black ticking does not indicate that the bird will not later show ticked feathers. The White Rocks and other white varieties such as the White Wyandottes often show a smoky appearance. This is not desirable in White Leghorns but is a common characteristic of the White Rocks and Wyandottes.

Barred.—The down of chicks that develop barred feathering is much like that of chicks which develop black. They differ, however, in one respect—they will show a lighter patch on the back of the head and occasionally lighter striping marks on the rump. This characteristic of the barred pattern is often used advantageously in crosses with other breeds for broilers or to obtain the advantages of hybrid vigor. Fig. 171 shows well marked Barred Plymouth Rock day-old chicks.

Black.—The down should be solid black on the upper part of the body. Lighter patches may be shown on the lower part of the body.

Buff.—The buff-colored varieties should show the same characteristic buff color in the down of the chicks as in the adult. There should be no distinct contrast between the down color of different parts of the body of the chick.

Brown-striped.—In case of breeds where the male shows some form of black-red color, as in case of Brown Leghorns or Partridge varieties, the down on the chicks will have a buff ground color but will show varying degrees of brown pattern. This pattern may be clear-cut or not so distinct. A dark brown stripe usually extends the length of the back, showing particularly on the head and the rump. (Fig. 172.)

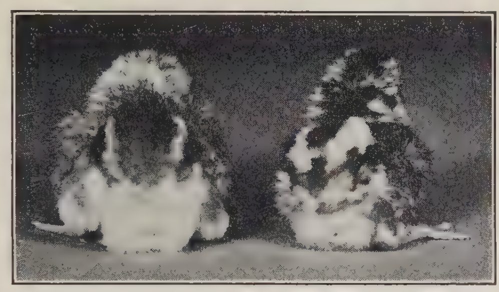


Fig. 172.—The Brown Striped Color Pattern.

The more uniform colored chick on the left is a Silver Gray Dorking and the chick on the right is a Golden Campine. The contrast of black, white and brown colors is not so sharp in the Dorking chick.

Silver-gray.—The colors of silver varieties will show about the same pattern as the brown-striped but the ground color of the down will be a pale creamy yellow in place of the buff.

Red.—Warren, 1929, reports that light-colored Rhode Island Red chicks should be eliminated, primarily because of the effect upon the under color of the adult birds. If only chicks of the very darkest shade of down color are kept the lighter colored adult birds will be avoided.*

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* Readers are referred to the American Standard of Perfection and to color plates of the Poultry Tribune, Mount Morris, Ill., for further information on color of baby chicks.

WEIGHT AND UNIFORMITY OF SIZE

Weight and uniformity of size are both given 10 points in most score cards. For entries of 25 chicks the standard weight is 2 pounds, and entries of 50 chicks should weigh 4 pounds. In order to produce chicks that will weigh at the rate of 8 pounds to the 100 chicks it is necessary to use for hatching, eggs weighing at least 24 ounces to the dozen. Many investigators have shown that the chick weight will approximate 65 per cent of the egg weight. Using 2-ounce eggs (24 ounces to the dozen) 100 eggs would weigh 200 ounces and 65 per cent of that would be 130 ounces. This would give a weight of 8.12 pounds to the 100 chicks. The usual cut is one point for every ounce below the standard weight.

Uniformity of Size.—This is another difficult quality to determine. It is tedious to weigh each individual chick. As a result uniformity is often judged by comparison. One-fourth point for every chick varying in size from the average entry is the usual cut made in scoring this character.

TRUENESS TO TYPE

The Iowa score card also allows 10 points for trueness to type. It is to be expected that this would be most difficult to judge and exceedingly hard to standardize. Trueness to type is difficult enough in case of adult birds for which we have a Standard of Perfection to show us the standard ideal type, but in case of chicks a standard showing the ideal type does not exist and would be difficult to formulate.

THE CONTAINER AND CONDITION UPON ARRIVAL

Fifteen points are allowed in the Iowa score card for condition of package and chicks on arrival at the show. This is a factor in the shipment of baby chicks which affects the quality of the chicks upon arrival at the farm of the purchaser and should be made a factor in case of judging baby chicks.

CUTS FOR DEFECTS

Dead chicks are cut heavily. The usual cut for each dead chick found upon arrival at the show is 5 points. This is a very legitimate cut, but little need is found for its application in the well-developed shows. The number of dead chicks present in the hundred or more entries is very small. This is due in part to the close selection made in making up the entry.

There are several disqualifications and defects which affect the quality of the various entries. These disqualifications are breed defects which can be distinguished at the time of hatching. They are:

1. Type of comb foreign to the breed.
2. Feathers on the shanks or down between the toes unless called for in the Standard of Perfection.
3. Side sprig on single comb.
4. Crooked toes or beaks. (Figs. 166 and 173.)
5. Crippled chicks. (Fig. 174.)
6. White varieties showing distinct black spots or showing a tinge of buff or red (does not apply to varieties which may be smoky, that is, White Rocks and Wyandottes).
7. Rhode Island Red chicks that are extremely light in color or show striped backs, or show dark brown or black on the wingbows, back or breast. (Fig. 168.)
8. Buff varieties showing black on top of the head or striped back.

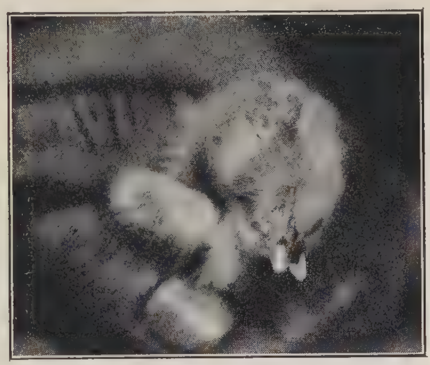


FIG. 173.—A Chick with a Crooked Beak.

Notice that the shape of the head is affected by this defect.

For many years Annual Judging Schools have been held for training in judging adult birds. Usually one-half day of that week's work is given over to judging baby chicks. It is possible, if interest in baby chick shows continues to grow as appears likely, that some of the state agricultural colleges will undertake to provide a special school for demonstrations and training in judging baby chicks. Much more must be learned about this special type of judging before an extensive course could be provided.

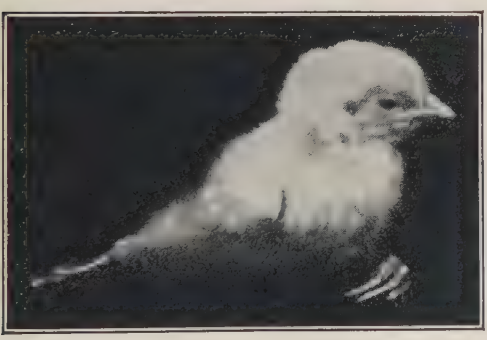


FIG. 174.—A Badly Crippled Day-old Chick.

Such a chick should be killed immediately.

CHAPTER XVIII

PRODUCTION JUDGING IN THE SHOW ROOM

EARLY PRACTICES

The judging of poultry is a very old practice. It consists of placing fowls according to their individual merits, based on an ideal or some recognized set of standards or characters. When the earliest poultry shows were held in England, and later in America, the judge placed the awards according to his own ideal or set of standards. In passing judgment upon birds it was necessary for him to consider the opinions of the leading breeders and judges at that time. As a great number of different varieties came to be produced and developed to a point where they could be reproduced relatively true to a given type and color, the need arose for definite standards.

This need was supplied by the American Poultry Association by means of the American Standard of Perfection which is published as a guide for breeders and judges of standard exhibition fowls. Two methods of judging are recognized by the American Poultry Association, namely, the score card and comparison systems. The score card system which was used by some judges during the early years of the association, has become practically obsolete, the comparison system being used almost exclusively in present-day standard shows. The business of the standard exhibition judge was to place the birds of a class according to the standard recognized by the American Poultry Association for the variety being judged. Therefore it was necessary for the judge to be familiar with all the standard requirements of the varieties which he was asked to judge. Methods of placing awards in standard judging and instructions are fully discussed in the American Standard of Perfection.

The judging of birds for production values, meat and eggs, and especially for characters indicating egg-producing qualities, is relatively new. Little was known concerning this phase of judging until long after the standards for exhibition poultry were established. Since 1910 this type of judging has made extremely rapid progress, due primarily to its economic importance. The first show to be held where only production classes were open for entry was at Cornell University, Ithaca, N. Y., in 1922. See Chapter XXI for methods of conducting this show. Previous to 1922 many fair exhibits opened classes for production birds. Since that time most of the large winter shows and state fairs have established production sections.

A New Type of Judge. With the development of the judging of birds for production values, a new type of judge has been developed. The production judge must not only be a standard exhibition judge but he must be familiar with the characters which indicate production values. He must know about the changes which take place in birds due to the function of egg production and know how to interpret those changes. The standard for production judging as outlined and set forth in the chapters of this book is a constantly changing standard, in the case of females, and this fact always must be considered by the production judge. Also this type of judging is interpretive judging, and because of this fact calls for a high degree of skill for its successful application. It is only after one becomes thoroughly acquainted with the external characters associated with egg production and experienced in their application that he can place proper emphasis on such characters as laying temperament, constitutional vigor or body type.

The placing of awards in production classes is done almost entirely by the comparison method. This is due to the fact that the emphasis to be placed on a certain physical character will vary, depending upon the time of year and whether pullets, hens or males are being judged. For example, more weight will be given to such characters as pigment and molt changes and handling quality in the case of hens which have been laying for several months than in the case of pullets which are just beginning to lay. There are no visible physical changes in males, caused by mating and the production of sperm, so that more emphasis must be placed on such characters as vigor, masculinity and body type than in females. The production judge must be familiar with these conditions.

Fortunately the physical changes which take place in birds due to the function of egg production are relatively the same for all the more important varieties used for this purpose. The differences which do occur are described in the particular chapters dealing with the individual characters.

PRODUCTION SCORE CARD

Score cards may be used to advantage in pointing out the various characters to be considered in production judging, but cannot be applied with any degree of success on a mathematical basis. For example a hen may rate very high in color, vigor and body type and yet not produce any eggs at all because of masculine characters indicated in the head type. Table 30 shows a score card with values totaling 100 points distributed among a number of the more important characters considered by a production judge, in placing awards in the showroom. The values given in this score card vary for a number of the characters, as between pullets and hens and females and males.

TABLE 33

A Production Score Card with Relative Values for Different Characters in Pullets, Hens and Males

Character	Pullets	Hens	Males
Vigor and sex dominance	15	15	20
Breed and Varietal Characteristics:			
1. Type	10	10	10
2. Color	10	10	10
Body conformation	20	10	20
Head type	20	20	20
Physical conditions:			
1. Pigment	5	10	5
2. Molt	..	10	
3. Handling quality	10	10	5
Laying temperament	10	5	
Totals	100	100	100

PRACTICES IN THE SHOW ROOM

The practices followed in the show room by the production judge will not vary materially from those of the standard judge. He will secure from the secretary of the show a record book indicating the classes to be judged and the coop number of the birds. Before handling any birds most judges will spend several minutes going over each class in order to get a general idea of the range in quality of the birds as far as it may be determined by general observation from the outside of the coop. Production birds, in general, are shown in their natural condition, and consequently have very little coop training. The judge must exercise care and patience in handling the birds, as hens or pullets in heavy production may be injured very easily by rough or careless handling.

After a general inspection of the class the judge should go over the class again, making a critical examination of the general type as seen from the outside of the coop for each bird, making such notations as he needs either on the coop tag or on a writing-pad, so that he may refer to them later. It is necessary to pose the individuals in order to see them in natural position as many production birds are very likely to assume a " squatty " position when placed in the exhibition coop. This is especially true in case of the heavier breeds. This part of judging often calls for extreme patience.

When the judge has completed his inspection of the birds from the outside of the coops he will then handle each bird in the class. Care must be exercised in removing the birds from the coops as broken plumage, especially in wings and tail, or other injury may result. A method of removing a bird from the coop is shown in Fig. 175. Most judges hold the bird in the left hand and make the examination of the various sections with the right hand. In removing the bird from the coop, gently turn the bird until it faces the door of the coop, then grasp the wing at the shoulder with the right hand and at the same time

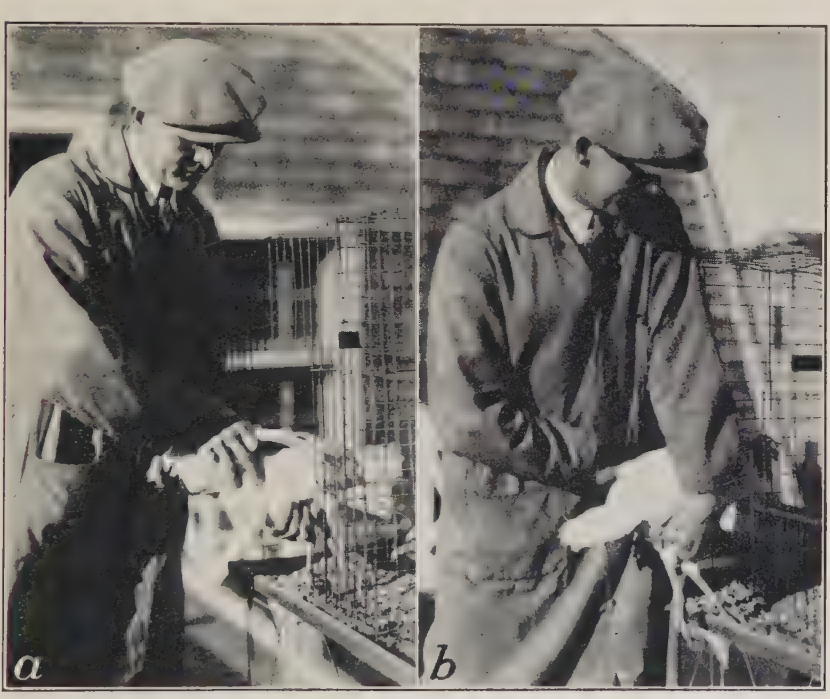


FIG. 175*a*.—Method of Removing Bird from Show Coop.
Note the bird is being taken out head first, the right hand grasping the wing.

FIG. 175*b*.—Method of Replacing Bird in the Coop.
Note that the bird is entering head first.

grasp the legs of the bird just above the hock joint with the left hand, always keeping the first finger, or first and second fingers between the bird's legs, and remove the bird from the coop head first.

The judge generally desires to rest the left foot upon some form of support as the edge of the coop, and allow the bird to rest on the thigh. (Fig. 176.) This makes for comfort for both the judge and the bird. The judge then makes a thorough examination of each of the various sections of the birds and notes the condition of the different characters. The bird is examined for both production and standard characters. He looks for all standard disqualifications and disqualifies where they are found. Standard defects are also considered. A bird should be replaced in the coop head first. Fig. 175 shows how this may be done.

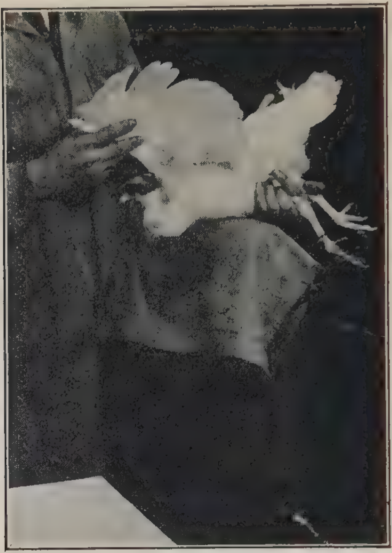


Fig. 176.—Correct Method of Holding Bird for Examination.

This position is comfortable for both the judge and the bird.

After each bird has been carefully examined the judge will often be able to eliminate immediately a number of birds from competition. In large classes where the number in the class has been reduced to the

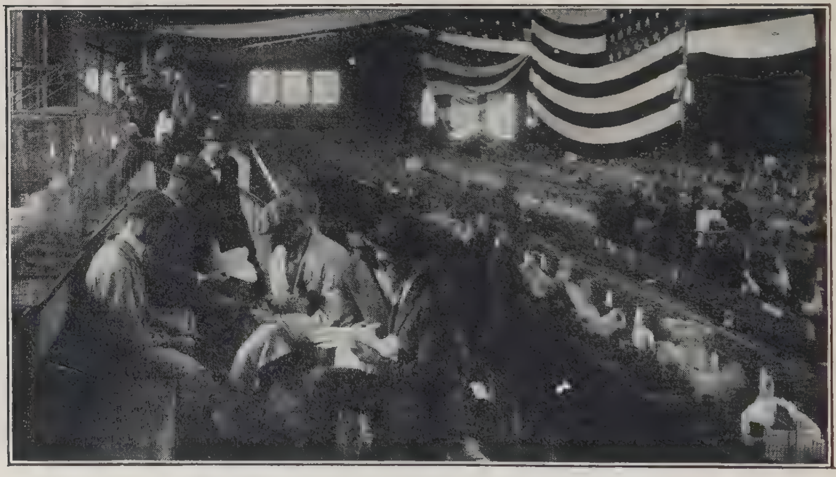


Fig. 177.—Judges Deciding the Sweepstakes.

last eight or ten birds it is a good practice to bring these birds together in special coops arranged for the purpose for final placing. Where the competition is keen these best birds may have to be handled several times before a final decision can be reached. After the placings have been made the judge should make it a point to answer questions freely and intelligently, giving the exhibitors or others interested the benefit of his reasons why certain awards and placings were made. Often an exhibitor who owns an unplaced bird or pen in a large class would like to know in what respect his entry was deficient. Such information should be gladly and clearly given.

The judge should personally check his placings in his record book and see that the coops are properly marked by the use of stickers or some other method indicating the awards made.

DEMONSTRATION JUDGING

Where possible the production judge should make his work a practical demonstration in the judging of birds for production values. It should be announced in the premium list and notice be given through the press that demonstration judging will be done by the judge, so that exhibitors and others interested may be present.

In handling the classes of birds the judge will go over each bird carefully, section by section, and point out to the exhibitors the various characters used in estimating values, and call attention to the desirable and undesirable features found in each individual. When making final placings complete reasons should be given orally, explaining the order of awards. This method of judging may be made very useful and effective as an educational demonstration in judging birds for production or standard values.

In many shows such a demonstration is impracticable because of the large amount of time required and the number and size of the different classes to be judged. Difficulty may be experienced because of lack of room. The noise made by the birds and the fact that persons are moving from place to place constantly add further difficulties.

Such demonstration judging may be used very effectively in 4-H Club shows and small fairs where the classes are small and plenty of time may be taken for the demonstration work.

The production judge places major emphasis on production value but gives due consideration to breed and varietal characteristics. In fact in certain breeds and varieties the placings of a production judge and an exhibition judge would not differ materially. This is especially true in case of the males in the general purpose varieties. The buying public at the present time is demanding that birds not only must have beautiful type and color but that these same birds must be so bred that when given proper feed and placed under suitable environmental conditions, they will produce eggs or meat economically. Hence there is an ever-increasing demand for judges who are not only trained in the judging of birds for standard characters but who also may pass judgment on the production values as well. This demand, in time, will bring about a condition where only one type of judge will be necessary, and where only one standard of judging will be used. That standard will be one which recognizes both exhibition and production values and places proper emphasis on each.

PART THREE

EDUCATIONAL FACILITIES IN POULTRY JUDGING

CHAPTER XIX

CONDUCTING POULTRY JUDGING SCHOOLS

During the past fifteen years a marked change has come about in the judging of poultry. Factors and characteristics indicating egg and meat production are now being given due consideration along with breed characteristics. Extension specialists all over the United States, for a number of years, have been giving culling demonstrations, and holding one-day culling schools in an effort to teach methods of eliminating the unprofitable producers and retaining desirable commercial layers and selecting the best birds for breeding. This work has had far-reaching results in raising the average production of thousands of farm flocks.

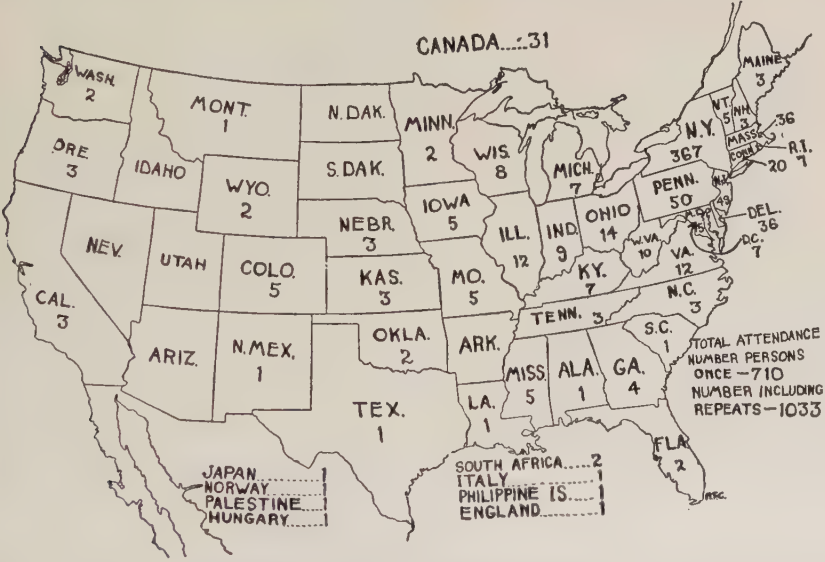

CANADA.....31
WASH. 2
MONT. 1
N. DAK.
MINN. 2
MAINE 3
VT. 5
NH. 3
MASS. 36
R.I. 7
CONN. 20
N.Y. 367
ORE. 3
IDAHO
S. DAK.
WIS. 8
MICH. 7
PENN. 50
N.J. 49
DEL. 36
D.C. 7
15
WYO. 2
IOWA 5
NEBR. 3
ILL. 12
IND. 9
OHIO 14
W.VA. 10
VA. 12
NEV.
UTAH
COLO. 5
KAS. 3
MO. 5
KY. 7
N.C. 3
CAL. 3
TENN. 3
S.C. 1
ARIZ.
N.MEX. 1
OKLA. 2
ARK.
MISS. 5
ALA. 1
GA. 4
TEX. 1
LA. 1
FLA. 2
TOTAL ATTENDANCE
NUMBER PERSONS ONCE—710
NUMBER INCLUDING REPEATS—1033
JAPAN.........1
NORWAY.........1
PALESTINE.....1
HUNGARY.......1
SOUTH AFRICA.....2
ITALY..........1
PHILIPPINE IS.....1
ENGLAND..........1

Fig. 178.—The Attendance at the Cornell University Poultry Judging School, 1918 to 1929, Inclusive.

The Development of the Judging School.—In 1918 the first judging school, a one-week short course, where production values were given major consideration, was held at Cornell University. This probably was the first school of its kind held. The purpose was the study, identification, description and application of the characters indicating production quality and production beauty in judging and breeding poultry for egg production and for meat production and to assist in the standardization of methods of judging poultry and eggs. The movement was for the development of breeds and varieties of poultry in conformity to the natural laws of development as influenced by, and as expressed in, production.

The practice of holding judging schools has spread to a number of states. In 1929 eight states were giving special work in the judging of birds for production. These special schools average about 5 days in length and range from 1 to 6 days. The range in attendance was from 20 to 125, with an average of about 60. Certificates are awarded at more than half of these schools for satisfactory completion of the course. The school at Cornell University has grown in enrollment from 39 to 127, the maximum number that can be handled by the system under which the school is conducted. Practically every state in the union and several foreign countries have been represented at the school. (Fig. 178.)

INSTRUCTION IN JUDGING SCHOOLS

The increase in our knowledge of the physical characters that indicate production quality in poultry and the great economic importance of the application of this knowledge to the selection of fowls for market, for commercial egg production, and for breeding purposes, make it desirable that systematic instruction in this method of judging shall be provided for resident teachers, extension workers, judges and commercial poultrymen.

The growing demand at poultry shows and agricultural fairs and in the extension field for persons who are skilled in the judging of poultry for egg production, for meat production, for standard qualities, and in the judging of eggs, calls for a standardization of methods in order that the ideals and ideas of the breeders, exhibitors, judges and extension demonstrators may be sound and in perfect accord. This offers a large and growing field for useful service.

The need for persons specially trained for research and teaching in this field is particularly urgent since the widely varying environmental conditions under which fowls are kept, especially as regards climatic conditions, artificial illumination, methods of feeding, and time of hatching, greatly influence the distribution of production and growth

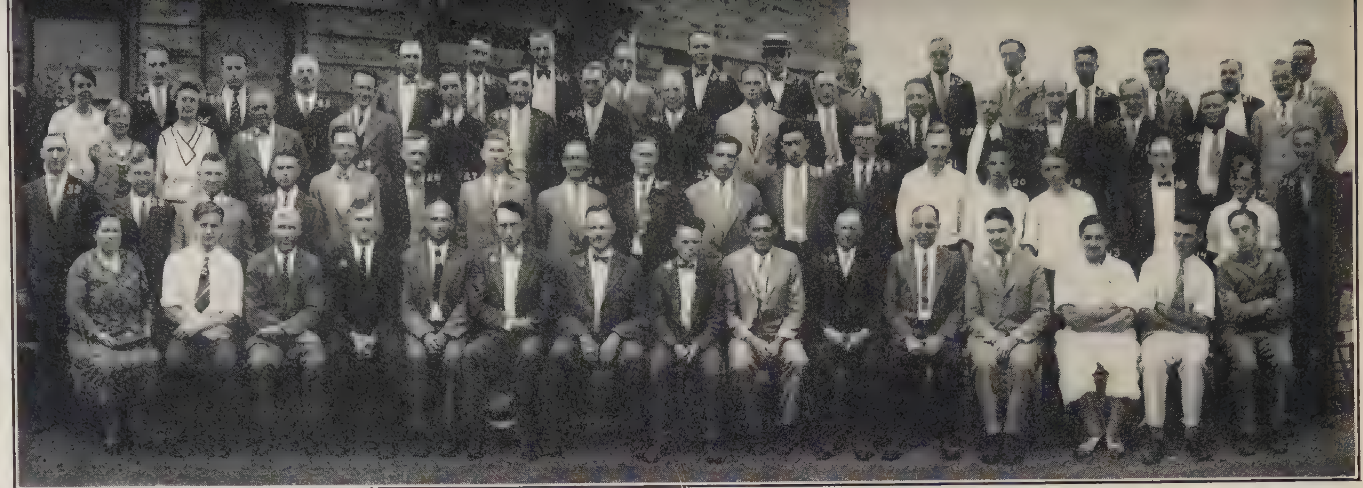


FIG. 179.—Twelfth Annual Judging and Breeding School—New York State College of Agriculture at Cornell University, Ithaca, N. Y., June 24–29, 1929.

1. Mrs. D. D. Montgomery, So. Plymouth, N. Y.
2. H. S. Wilgus, Ithaca, N. Y.
3. M. C. Herner, Winnipeg, Man., Can.
4. G. O. Hall, Ithaca, N. Y.
5. J. G. Halpin, Madison, Wis.
6. H. H. Steup, Mt. Morris, Ill.
7. L. M. Hurd, Ithaca, N. Y.
8. F. E. Andrews, Ithaca, N. Y.
9. J. C. Huttar, Ithaca, N. Y.
10. R. C. Ogle, Ithaca, N. Y.
11. H. E. Botsford, Ithaca, N. Y.
12. J. Vandervort, State College, Penna.
13. E. S. Schneider, Budapest, Hungary
14. E. D. Smith, Bridgeville, Del.
15. R. M. Foy, Clinton, Iowa
16. Thomas Dorsey, Clinton, Iowa
17. A. G. Bedell, St. James, L. I., N. Y.
18. M. L. Rogers, Churchville, N. Y.
19. F. W. Lucas, Silver Creek, N. Y.
20. M. C. Babcock, Dunkirk, N. Y.
21. C. B. Gauss, Holcomb, N. Y.
22. M. M. West, Lansdale, Pa.
23. George E. Goss, Castleton, N. Y.
24. S. A. Neal, Lyndonville, N. Y.
25. James Dixon, Ithaca, N. Y.
26. H. H. Gabelman, Trumansburg, N. Y.
27. W. Palmer Hatfield, Greenwood, Del.
28. O. S. Dorsey, Clinton, Iowa
29. R. H. Orton, North East, Penna.
30. G. W. Horsey, Frankford, Del.
31. Wilson C. Hatfield, State Board of Agr., Dover, Del.
32. Robt. F. Catrow, Ithaca, N. Y.
33. L. A. Muckle, Lockport, N. Y.
34. Lois A. Turner, Rochester, N. Y.
35. Louise E. Dawley, Mexico, N. Y.
36. James A. Farley, Roscoe, N. Y.
37. Walter S. Rich, Hobart, N. Y.
38. A. C. Davidson, Ithaca, N. Y.
39. M. F. Monagle, Rushville, N. Y.
40. Martin DeGarmo, Valois, N. Y.
41. Eli H. Bodine, Chemung, N. Y.
42. G. M. Bass, Cazenovia, N. Y.
43. Joseph A. McLoughlin, Chatham Center, N. Y.
44. R. S. Brillock, Hoosick Falls, N. Y.
45. H. B. Allen, Tully, N. Y.
46. Glenn L. Wallace, Chazy, N. Y.
47. Ethan J. Randall, Skaneateles, N. Y.
48. H. Kaplowitz, Kingston, N. Y.
49. H. C. Smith, Morgantown, W. Va.
50. Wallace H. Rich, Hobart, N. Y.
51. Allen J. Powell, Schaghticoke, N. Y.
52. R. S. Wooster, Randolph Center, Vt.
53. Robert H. Hill, Jamestown, N. Y.
54. John H. Craig, Westfield, N. Y.
55. H. R. Baker, Dover, Del.
56. George Cornwell, Yorktown Heights, N. Y.
57. R. L. Montgomery, Simsbury, Conn.
58. Geo. S. Robinson, Alfred, N. Y.
59. W. W. King, Ithaca, N. Y.
60. Fred Ruehle, Pleasant Valley, N. Y.
61. W. A. Hebert, Henrietta, N. Y.
62. Chas. A. Bookmyer, Clyde, Ohio
63. Fred Walter, Egg Harbor City, N. J.
64. B. C. McGrew, Washington, Penna.
65. William Bowers, Jr., Newton Square, Penna.
66. Emma B. Gardner, West Burlington, N. Y.

*Absent:
Professor J. E. Rice, Ithaca, N. Y.
G. P. Rhodes, Buffalo, N. Y.
D. R. Marble, Ithaca, N. Y.
John B. Holloway, Durham, N. C.
J. S. Putnam, Dryden, N. Y.
L. E. Weaver, Ithaca, N. Y.

and thus make difficult the accurate judging of fowls by means of external characters.

The breeding and judging of poultry for standard quality is a well developed art. The breeding and judging of poultry with respect to productve quality is progressing rapidly. Radical differences of opinion still exist between those who judge poultry for standard quality and those who judge for productive quality, although these differences are rapidly diminishing as the standard makers are coming more and more to appreciate the fact that the judging of birds for production has passed successfully through the experimental stage and is being demanded by the best breeders and exhibitors of the country.

Fig. 180.—Instruction Staff of the Seventh Annual Poultry Judging and Breeding School, New York State College of Agriculture at Cornell University, Ithaca, N. Y., July 7–12, 1924.

1. Graham, W. R.
2. Rice, J. E.
3. Heuser, G. F.
4. Payne, L. F.
5. Halpin, J. G.
6. Knandel, H. C.
7. Foreman, E. C.
8. Weaver, L. E.
9. Botsford, H. E.
10. Ogle, R. C.
11. Hurd, L. M.
12. Vandervoort, Jr.
13. Hall, G. O.
14. Kent, O. B.
15. Card, L. E.
16. Powell, C. K.
17. Krum, W. G.
18. Norris, L. C.
19. Lewis, H. R.
20. Allen, W. H.
21. Huttar, J. C.
22. Quigley, T.
23. Bradley, R. C.
24. Andrews, F. E.

It is hoped that through research and teaching there may be brought about a better understanding of the important breed characteristics and how they should be developed in order to conform to the demands of nature and thus secure and maintain the highest production quality. This will hasten the time when we shall have but one standard of judging and one class of judges. The modern poultry judge must so harmonize the production and beauty values that the maximum of beauty consistent with the highest production quality will be accepted as the ideal in the judging of all of our breeds and varieties of poultry. We will then fully understand the meaning of a new term: Production-beauty. Production-beauty cannot be understood or appreciated unless the judge is thoroughly familiar with true production quality.

Production quality is not a breed characteristic. It is a combination of many individual characteristics which are not confined to any single breed or strain and which may be found in certain individuals of any breed or strain. Production quality is the external evidence of high production. Each year as a result of increased knowledge and experience production judging is becoming more effective. Much new information becomes available each year. This new information can be acquired only by putting it into actual practice. Poultry judging schools held by various agricultural colleges offer such an opportunity to advance our knowledge and skill in production judging.

A description of the methods used in conducting the annual judging school at Cornell University will give an idea of the work carried out in such a school. The buildings, equipment and staff of the Poultry Department of the college are utilized. Many of the best-known teachers, investigators, judges and successful poultrymen are used on the non-resident teaching staff.

METHOD OF CONDUCTING A JUDGING SCHOOL

For the proper conduct of a production poultry judging school large numbers of trapnested birds are essential. These should be selected in advance of opening the school and with a special object in view of having the individuals represent as accurately as possible the contrasts in qualities and characters to be studied and compared. Other teaching material consists of colored lantern slides, photographic enlargements, mounted skeletons and colored charts prepared especially for teaching the subject of judging fowls for egg production and meat production and for judging eggs.

The method of instruction is of the regular class-room lecture and laboratory type. The plan is distinctly that of a school and not of a conference or convention. The instruction is largely by demonstration and laboratory practice in the handling of fowls. For this purpose the class is divided into groups of from twelve to fifteen each, with each section in charge of one or more instructors. All instructors are interchanged at frequent intervals. This enables students to receive individual attention and to become familiar with the special methods of all of the instructors who have charge of the various sections. The instructors are also given an opportunity to visit all of the laboratory sections in order that they may observe the teaching methods of the other instructors.

In order to provide instruction for those who are best qualified to apply it, admission is limited to persons who are professionally engaged in resident or extension teaching, research, judging, writing, or who are college students specializing in the field of Poultry Husbandry, or persons who are managing a poultry enterprise as an important part of a business and who are at least eighteen years of age.

The large size of the class prevents the admission of visitors, except in the lecture room. Five days are spent in classroom and laboratory work, the various characters used in determining production values being taken up one at a time, first in the classroom and then in the laboratory practice work, and finally practice is given in judging birds and eggs, all characters being considered. On Saturday morning an examination is given which includes questions to be answered and birds to be judged that will test the student's knowledge and skill in judging poultry for production and breed characteristics, as well as the judging of eggs.

The following is the outline of one day's program during the judging school held in 1926 at Cornell University.

9:00–10:00 a.m.	The Head: Nervous energy and vitality as indications of production quality.
10 a.m.–12 m.	Judging Fowls for Egg Production: The head, the eye, the color, size and texture of comb and nervous energy; Leghorns, Rocks, Reds and Wyandottes. (All members of the teaching staff participating.)
12 m.– 1:15 p.m.	Luncheon.
1:15– 2:45 p.m.	The Molting Factor as a Means of Selection for Production: Results of recent observations on molting.
2:45– 3:30 p.m.	Handling Quality as an Indication of Prolificacy.
3:30– 5:00 p.m.	Judging Fowls for Egg Production: Handling quality, size and condition of vent; texture and pliability of skin and abdomen. Molting: Leghorns, Plymouth Rocks, Reds and Wyandottes. (All members of the teaching staff participating.)
5:00– 6:00 p.m.	Campus and farm inspection trips.
6:00– 7:00 p.m.	Dinner.
7:00– 8:00 p.m.	Outdoor sports.
8:00– 9:30 p.m.	Relation of internal anatomy to intensity, cycle and annual egg production in White Leghorns.

Figs. 181 to 186 illustrate the outlines used in the laboratory practice.

Coop No.	Band No.	Vent	Eyering	Earlobe	Beak	Shanks	Rest Periods	Laying or not	Estimated Production for past 10 weeks	Actual Production for past 10 weeks
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

Key to color grades: O—No color; X—Slightly yellow; XX—Medium yellow; XXX—Original color.

FIG. 181.—Form Used for Studying the Pigmentation of Fowls at the Cornell Poultry Judging School.

		VENT			AB-DOMEN		SKIN		MOLT							
Coop No.	Band No.	Size	Shape	Condition	Size	Quality	Thickness	Pliability	Neck	Body	Primary Wing	Secondary Wing	Tail	Rest Periods	Estimated Production to date	Actual Production to date
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																

FIG. 182.—Form Used for Studying Handling Condition and Molt at the Cornell Poultry Judging School.

		HEAD							MENTALITY						
Coop No.	Band No.	Rugged Refined	Refined	Overly Refined	Crowhead	Coarse	Phlegmatic	Masculine	Expression	Disposition	Intelligence	Estimated Production to date	Actual Production to date		
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															

Fig. 183.—Form Used for Studying the Head Type and Temperament at the Cornell Poultry Judging School.

		BACK				DEPTH		KEEL							PRODUCTION		
Coop No.	Band No.	Width	Carry Back	Spring of Ribs	Fleshing	Front	Back	Length	Curvature	Breast Fleshing	Abdominal Capacity	Shank Shape	Pelvic Bones	Lateral Processes	Estimated Production to date	Actual Production to date	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	

Fig. 184.—Form Used for Studying the Body Type of Laying Hens at the Cornell Poultry Judging School.

Coop No.	Band No.	Pigmentation	Molt	Head Type	Handling Quality	Body Type	PRODUCTION	
							Estimated	Actual
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

FIG. 185.—Form Used for Studying All Production Characters at the Cornell Poultry Judging School.

Coop No.	Band No.	Age	Sex	Pigment	Type	Head	Body	Legs	Temperament	Maturity	Fleshing	Feathering		
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														

FIG. 186.—General Form Which Considers Characters that May Be Used for Judging Cockerels and Pullets. This is the Form Used at the Cornell Poultry Judging School.

The following is a compact statement of procedure, describing a method of judging chickens for egg production which was first formulated in 1918[1] at the First Annual Judging School, held at Cornell University. It has been revised each year since 1918 by the instructing staff at the Annual Cornell Poultry Judging School. This is the 1929 revision.

A METHOD OF JUDGING CHICKENS FOR EGG PRODUCTION

This method was first formulated July 1–6, 1918, at a Judging School held at Cornell University, Ithaca, New York. The method was approved by the American Association of Instructors and Investigators in Poultry Husbandry. Since that time it has been revised in July of each year by representatives of poultry departments in the agricultural colleges of Connecticut, Illinois, Indiana, Kansas, Massachusetts, Michigan, New Jersey, New York, Ontario, Oregon, Pennsylvania, Wisconsin, Delaware and Kentucky.

The Characters Used in Selecting Birds for Egg Production

In order to lay well, a hen must be vigorous and healthy and have a sound body. Vigor and Health are indicated by bright, clear eyes, a well developed body and an active disposition.

There should be no *physical defects* (such as crooked beak) which would prevent the bird from securing an abundance of feed.

Inheritance is of major importance in producing high layers. Birds may be found with good body type but lacking the inherited tendency to heavy egg production.

Head.—The head should be clean-cut and well balanced. It should be of medium length and depth, wide and flat, the width increasing uniformly from attachment of beak to a point directly back of eye. The eyes should be large, bright and prominent. A smooth and lean condition of the skin covering the face is desirable. The head should be neatly attached to the neck, avoiding all tendency toward throatiness. Types to be avoided are thick, prominent jaws, narrow skulls, heavily wrinkled or shallow faces, small or sunken eyes, overhanging eyebrows or combs with extremely narrow serrations. Head type may be used in judging birds of any age or sex at any time of the year.

Body Type and Shape.—The type and shape of a female indicates her capacity which may be used as an indication of ability to produce eggs efficiently. Type and shape can be used in judging birds of any breed, age or sex at any time of year.

In order to make a high yearly record a hen must lay not only for a long time but at a rapid rate. She must have the capacity and ability to utilize large amounts of feed rapidly and efficiently.

The back should be wide over its entire length and free from hard fat. A narrow spring of ribs or a back that tapers decidedly or slopes sharply to the rear indicates small capacity. The back line should be approximately straight and the underline should be nearly parallel.

The breast should be full, deep and prominent; the neck fairly short, blending well with the head and body. The legs should be of moderate length, and the shanks flat on the sides rather than round.

The keel bone should be long, and straight or rocker shaped.

[1] See page 39.

The body should be deep. Care should be taken not to become confused between birds that appear deep because of long, loose feathering and birds that have actual body depth. Depth may be measured by placing the thumbs on the middle of the back with the little finger on the front end of the keel and the middle fingers on the rear of the keel bone. Press in lightly with the palms of the hands, but do not squeeze the bird. Depth of front and rear may be measured by spanning the body from back to breast with the thumb and middle finger and sliding them along the keel and back.

Body Changes Due to Laying.—A laying hen has a large, moist vent, showing a wide, dilated condition in contrast to the small, dry, puckered vent of a hen that is not laying.

The abdomen of a laying hen is enlarged, the pelvic arch spread and the keel forced down. The more eggs a hen is going to lay the following week, the greater is the size of her abdomen. The actual size of abdomen is influenced by size of bird, length of keel and size of eggs laid. A sagging abdomen is undesirable.

Egg-laying condition is shown by the quality of *skin* and the apparent thickness of *pubic bones.* Fat goes out of the body with production, so that a heavy producer has a soft, velvety skin. The abdomen is soft and pliable. The more fat on the pubic bones and the greater the amount of hard fat in the abdomen, the less has been the production or the longer has been the time since production ceased.

Changes in Secondary Sexual Characters.—The *comb, wattles* and *earlobes* enlarge or contract, depending upon ovarian activity. If a bird is laying heavily, the comb, wattles and earlobes are large, full, plump, smooth and waxy. If the comb is limp, the bird may be laying, but when the comb is dried down, especially at molting time, the bird is not laying. If the comb is warm, it is an indication that the bird is laying or is coming into production.

Color or Pigmentation Changes. (These should be observed by daylight.)—In yellow-skinned breeds the different parts of the body become white or bleached, according to the length of time the bird has been laying. It should be recognized that all yellow color changes are dependent on health, management, feed, coarseness of the skin and size of the bird. A heavy bird fed on an abundance of green feed or other material that will color the outer tissues yellow, will not bleach nearly so quickly as a smaller or more lightly colored bird. A bird with rich yellow shanks does not fade so quickly as does a bird with pale yellow shanks. The changes occur in the following order:

The *vent* changes very quickly with egg production so that a white or pink vent on a yellow-skinned bird generally means that the bird is laying, whereas a yellow vent means that the bird is not laying.

The *eyering,* that is, the inner edge of the eyelids, bleaches a trifle more slowly than the vent. The earlobes on Leghorns and Anconas bleach out a little more slowly than the eyering so that a bleached earlobe means a little longer or greater production than does a bleached vent or eyering.

The *beak* loses color first at the base, the color gradually disappearing until it finally leaves the front part of the upper mandible. The lower mandible bleaches more rapidly than the upper, but may be used as an indication of egg production where yellow is obscured by horn or black pigment. On the average yellow-skinned bird, a bleached beak means production for at least the preceding four to six weeks.

The *shanks* are the last to loose color and hence if bleached indicate a long period of production. The yellow color goes first from the scales on the front of the shanks and finally from the scales on the rear. The scales on the hock of the shank and the tops of the toes are the last to bleach and may be used as an index to natural depth of yellow color of the bird until the color is entirely bleached out. A bleached shank usually indicates production for at least eight to twenty weeks.

Molting.—When a bird stops laying in the summer, she usually starts molting. The later a hen lays in the summer or the longer the period over which she lays, the greater her production, hence the high producer, as a rule, is a late layer and a late molter.

The length of time that a hen has been molting or the time since she stopped laying may be determined by the molting of the primary feathers. It takes about six weeks to renew completely the primary feather next to the axial feather. The remaining primary feathers are usually dropped in order, and grow at the same rate.

Many hens may molt and lay at the same time.

A high producer frequently molts several primary feathers at one time. In calculating the length of time a bird has been molting, all primary feathers shed at the same time should be considered as one feather.

Temperament and Activity.—A good layer is active, intelligent, friendly and more easily handled than a poor layer. A low producer is shy and flighty and is inclined to stay on the edge of the flock.

Note. When culling a flock, careful consideration must be given to the following factors: Time of year, age, breed, feed, range, methods of management, and whether in production or out of production.

CHAPTER XX

POULTRY JUDGING CONTESTS

As early as 1909 poultry judging contests were held in the United States where college students took part in competitive judging. In most of these contests there have been both production and standard classes, different birds being used for the two types of judging. In 1922 a committee appointed by the president of the American Association of Instructors and Investigators in Poultry Husbandry (now the Poultry Science Association) made a report on rules and regulations for national and district poultry judging contests among college students. The rules and regulations reported by the committee, with some modifications, are now in use by the Eastern District or judging conference.

College student contests are being held annually by two districts of the United States. The country, for this purpose, is naturally divided into three districts: (1) New England and the states south of the Ohio and east of the Mississippi Rivers; (2) the Middle West, which extends to the Rocky Mountains, and (3) the Far West or the states on the Pacific Coast. The Eastern and Middle West Districts have been active for the past several years and the rivalry between colleges is very keen. A few teams from the eastern provinces of Canada have competed.

The rules and regulations adopted at Corvallis, Oregon, in 1922, by the Poultry Science Association were approved at the Annual Intercollegiate Poultry Judging Contest at Madison Square Garden, New York City, January 25, 1924, as the rules and regulations to be followed by the Eastern Inter-collegiate Poultry Judging Contest in the future. These rules with some changes which have been made since their adoption are as follows:

Name.—Varies with different districts.

Place and Time of Contest.—This may be different for every contest, but the time should be 8:30 a.m.

Superintendent of Contest.—Some member of the Poultry Science Association who is interested should be chosen by coaches of competing teams in the contest during the preceding year. This superintendent should be at the head of the entire contest.

Prizes.—The obtaining and assembling of prizes should be in charge of some

FIG. 187.—Four Champion Inter-collegiate Poultry Judging Teams.

1. *Upper*—Cornell University team, 1928. (G. O. Hall, Coach.)
2. *Middle right*—Connecticut Agricultural College team, 1930. (Courtesy D. E. Warner, Coach.)
3. *Middle left*—North Carolina State College team, 1927. (Courtesy W. F. Armstrong, Coach.)
4. *Bottom*—Kansas Agricultural College team, 1930. (Courtesy H. M. Scott, Coach.)

member of the Poultry Science Association, chosen by those colleges competing in previous contests. This person should be responsible to the superintendent.

Selection of Birds to be Judged.—This should be in charge of some member of the Poultry Science Association chosen by those contesting the previous year. This person should have complete charge of the birds that are to be used in the contest.

Method of Grading Contestants.—This work should be in charge of a person who is a member of the Poultry Science Association chosen by the contestants of the previous year. All suggestions and results of experience should be used in working out a satisfactory system of grading. This system should be gone over by the coaches in charge of contestants on the night before the holding of the contest.

Classes of Birds to be Judged.—One class each of Single Comb White Leghorns, Barred Plymouth Rocks, Single Comb Rhode Island Reds, and White Wyandotte hens for production judging and one class each of Single Comb White Leghorn cocks, Single Comb Rhode Island Red cockerels, White Wyandotte hens and Barred Phymouth Rock pullets for standard judging. There shall be four or five birds in each class.

Method of Placing Awards.—The hens in the production classes will be judged from actual trapnest records of their first laying year. The standard birds will be judged and placed by a properly qualified standard exhibition judge who may invite assistance if he so desires or by a committee of coaches. The decision of the judge or committee on any special class will be final. All standard birds will be judged according to the American Standard of Perfection.

Time of Contest.—The contest will commence at 8:30 in the morning on the date chosen and 15 minutes will be allowed for judging each class when there are four birds and 20 minutes when there are five birds. No intermission will be allowed any contestant and he will judge all classes without rest.

Membership of Team.—There will be three members of each team with one alternate (optional). Membership on the team is open to any student who is regularly enrolled in the four-year agricultural course, has been in attendance at the college he represents at least one full school year, and at the time of the contest is regularly enrolled at the college where he has completed one year's work, and whose work in his classes is of a passing grade. Instructors or coaches in charge of each team shall be responsible for the credentials of that team. No student is eligible for more than one contest. Every college sending a competing team will file with the superintendent of the contest, one week prior to the contest, the names of the coach, the three contestants and the alternate with the class numerals of each. This list may be changed immediately prior to the contest if the colleges desire.

Methods of Judging Contestants.—There will be no reasons required for any placings made. A system or method of grading of contestants will be agreed upon by the coaches in charge of the team in meeting on the night before the contest.

Each team shall be on hand at a designated place at least 30 minutes prior to the commencing of the contest. The actual supervision of the contest shall be in charge of the superintendent selected by the coaches of the preceding contest. This superintendent shall have charge of the management and the details of the contest and all matters pertaining to it shall be referred to him unless otherwise provided for.

A person shall be selected by the superintendent to be in charge of the contest room during the contest and any contestant desiring to converse or ask questions while judging must appeal to this person.

Each student judge shall be required to write his placings on a blank which shall be provided, this blank to be handed to the person in charge of the contestants as soon as the class has been judged. A record blank will bear the contestant's number, the name of the class to be judged and the placings of the birds in the class. [Fig. 188 shows the form of card used.]

The birds in the production classes to be judged shall be sent in by a college poultry department, or experiment station or shall be birds bearing official egg laying contest bands, which have authentic trapnest records. The birds shall be shipped so as to reach the show at least one full day, and probably two, before the opening of the judging contest. They shall be cooped in a separate room and in single tiers of coops, so arranged as to obtain the best light possible and provide convenience for the contestants. The egg records of these birds will be mailed in sealed envelopes to the superintendent prior to the contest. The outside of these letters will be marked "Egg Records." They will not be opened until the committee on awards asks for them.

The birds in the standard classes to be judged shall be taken either from unplaced birds in the show room or be shipped in for contest purposes. They will be shipped and placed in a manner similar to birds in the production classes. The birds will be placed as previously described, prior to the contest, and these placings kept in a sealed envelope until such time as the committee on awards asks for them.

The committee on awards consisting of four men will be selected by the coaches of the teams competing. Awards will be compiled on the basis of the numbers of the contestants. Appeals on decisions may be made by this committee but the conclusions made at the close of the contest shall be final.

In case of a tie in scores, the decision will be given to the team or individual having the greatest number of perfect scores, and if the tie still persists, to the greatest number of scores of 90, etc. To the winning team shall be awarded a silver trophy to become the property of the institution represented. Silver cups shall also be awarded to teams winning second and third places in the total score.

To the individual with the highest score a grand champion gold medal will be awarded. To the individuals ranking first, second and third in production judging and to the individuals ranking first, second and third in standard judging shall be awarded gold, silver and bronze medals respectively.

To the individuals ranking first, second and third in judging both production and standard classes shall be awarded suitably inscribed ribbons—blue, red and white in color.

A written examination will be substituted for disqualifications in the standard classes covering designated sections of the American Standard of Perfection.

The Eastern Inter-collegiate Contest is held at Madison Square Garden Poultry Show, in New York City, which occurs in January of each year. In the Middle West District the contest is held at the Coliseum Poultry Show in Chicago, Illinois, which is usually held in December of each year. It has been the practice with the eastern contest to select one of the coaches from the competing colleges to act as superintendent or general chairman of the contest. Another one of the coaches is appointed as chairman of the awards committee, and this person is responsible for soliciting funds with which to purchase prizes, and seeing that the cups are obtained and properly engraved. This person is also made responsible for suitable blanks on which the scores of the contestants can be tabulated and checked.

The general chairman takes charge of securing the birds to be judged although it is a good practice for him to ask other coaches to be responsible for certain classes of birds, as it is sometimes difficult for one man to secure so many classes and obtain suitable birds in all cases. In selecting the birds to be judged it is important that there should be considerable gradation in quality ranging from the poorest bird to the best, so that the students will have some basis for their judgment, or otherwise the contest may become a guessing competition. At best the students are only amateurs and not finished judges. The records of the production birds should vary by twenty to twenty-five eggs each and freak birds should not be allowed in the contest.

METHOD OF DECIDING AWARDS

The method of grading the placings of the students is decided upon the night before the contest. The method that has been generally followed and that has given most satisfaction is a plan whereby all the possible placings that can be made in five bird groups have been worked out in advance. Table 35 illustrates all the possible placings for five birds. Table 34 shows all possible placings for a four-bird group. With a little practice one is able to make the necessary shifts, from the

TABLE 34

All Possible Combinations of Placings and Resulting Scores with Four Individuals in a Class

The column on the right shows an approximate score

(New York State College of Agriculture at Cornell University, Ithaca, New York. *Department of Poultry Husbandry.*)

Grade Sheet

(4 individuals in a Class)

1 2 3 4	100	or 100	3 1 2 4	68	or 70
1 2 4 3	84	80	3 1 4 2	50	50
1 3 2 4	84	80	3 2 1 4	50	50
1 3 4 2	68	70	3 2 4 1	32	30
1 4 2 3	68	70	3 4 1 2	32	30
1 4 3 2	50	50	3 4 2 1	16	20
2 1 3 4	84	80	4 1 2 3	50	50
2 1 4 3	68	70	4 1 3 2	32	30
2 3 1 4	68	70	4 2 1 3	32	30
2 3 4 1	50	50	4 2 3 1	16	20
2 4 1 3	50	50	4 3 1 2	16	20
2 4 3 1	32	30	4 3 2 1	0	0

TABLE 35

ALL POSSIBLE COMBINATIONS OF PLACINGS AND RESULTING SCORES WITH FIVE INDIVIDUALS IN A CLASS

(New York State College of Agriculture at Cornell University Ithaca, New York. *Department of Poutry Husbandry.*)

GRADE SHEET

(5 individuals in a Class)

In the upper left-hand column is the perfect score of 100 points, or 1, 2, 3, 4, 5. If a member should place the exhibits 3, 4, 2, 1, 5, we find in the first column his score to be 50 points. Any combination can be located quickly and the score found in the same way.

Grade Sheet

1 2 3 4 5	100	2 1 3 4 5	90	3 1 2 4 5	80	4 1 2 3 5	70
1 2 3 5 4	90	2 1 3 5 4	80	3 1 2 5 4	70	4 1 2 5 3	60
1 2 4 3 5	90	2 1 4 3 5	80	3 1 4 2 5	70	4 1 3 2 5	60
1 2 4 5 3	80	2 1 4 5 3	70	3 1 4 5 2	60	4 1 3 5 2	50
1 2 5 3 4	80	2 1 5 3 4	70	3 1 5 2 4	60	4 1 5 2 3	50
1 2 5 4 3	70	2 1 5 4 3	60	3 1 5 4 2	50	4 1 5 3 2	40
5 1 2 3 4	60	1 3 2 4 5	90	2 3 1 4 5	80	3 2 1 4 5	70
5 1 2 4 3	50	1 3 2 5 4	80	2 3 1 5 4	70	3 2 1 5 4	60
5 1 3 2 4	50	1 3 4 2 5	80	2 3 4 1 5	70	3 2 4 1 5	60
5 1 3 4 2	40	1 3 4 5 2	70	2 3 4 5 1	60	3 2 4 5 1	50
5 1 4 2 3	40	1 3 5 2 4	70	2 3 5 1 4	60	3 2 5 1 4	50
5 1 4 3 2	30	1 3 5 4 2	60	2 3 5 4 1	50	3 2 5 4 1	40
4 2 1 3 5	60	5 2 1 3 4	50	1 4 2 3 5	80	2 4 1 3 5	70
4 2 1 5 3	50	5 2 1 4 3	40	1 4 2 5 3	70	2 4 1 5 3	60
4 2 3 1 5	50	5 2 3 1 4	40	1 4 3 2 5	70	2 4 3 1 5	60
4 2 3 5 1	40	5 2 3 4 1	30	1 4 3 5 2	60	2 4 3 5 1	50
4 2 5 1 3	40	5 2 4 1 3	30	1 4 5 2 3	60	2 4 5 1 3	50
4 2 5 3 1	30	5 2 4 3 1	20	1 4 5 3 2	50	2 4 5 3 1	40
3 4 1 2 5	60	4 3 1 2 5	50	5 3 1 2 4	40	1 5 2 3 4	70
3 4 1 5 2	50	4 3 1 5 2	40	5 3 1 4 2	30	1 5 2 4 3	60
3 4 2 1 5	50	4 3 2 1 5	40	5 3 2 1 4	30	1 5 3 2 4	60
3 4 2 5 1	40	4 3 2 5 1	30	5 3 2 4 1	20	1 5 3 4 2	50
3 4 5 1 2	40	4 3 5 1 2	30	5 3 4 1 2	20	1 5 4 2 3	50
3 4 5 2 1	30	4 3 5 2 1	20	5 3 4 2 1	10	1 5 4 3 2	40
2 5 1 3 4	60	3 5 1 2 4	50	4 5 1 2 3	40	5 4 1 2 3	30
2 5 1 4 3	50	3 5 1 4 2	40	4 5 1 3 2	30	5 4 1 3 2	20
2 5 3 1 4	50	3 5 2 1 4	40	4 5 2 1 3	30	5 4 2 1 3	20
2 5 3 4 1	40	3 5 2 4 1	30	4 5 2 3 1	20	5 4 2 3 1	10
2 5 4 1 3	40	3 5 4 1 2	30	4 5 3 1 2	20	5 4 3 1 2	10
2 5 4 3 1	30	3 5 4 2 1	20	4 5 3 2 1	10	5 4 3 2 1	0

placing made by the student, to get the correct placing and determine the score without the table. Each shift from the correct placing has a value of 10, as it takes ten shifts to get the birds back in the correct order if they are completely reversed, in case of a five-bird class. The placings in the contest are all double checked, one person using the long method and the other person using the grade sheet.

The written examination covers certain designated parts of the American Standard of Perfection, and consists of fifty questions, which may be answered by inserting the word "True" or "False" or by indicating whether a certain statement of a condition is normal, a defect or a disqualification.

In placing either the standard or production classes, standard disqualifications are not taken into consideration in placing the birds, this work being covered by the written examination. A great deal of difficulty has been experienced in past years with disqualifications due to the fact that sometimes the judge in placing the birds would overlook a disqualification and place a bird first which should have been disqualified. Some students then find the disqualification and place the bird fifth, which is unfair to the student when the judge's placing has to be accepted as final. Under the present system if a disqualification is found by the student it is ignored and the bird is placed on its type and color. This system makes it just as necessary for the student to know what a disqualification is as if he were to disqualify the bird, for if it is not a disqualification a cut for a defect must be considered in placing the bird. The score of the written examination counts half of the standard score in the final placing of teams and individuals.

It has been very interesting to note that in the last few years the scores of the production classes have been more uniform and somewhat higher than the scores for the standard classes.

Under the system of awarding prizes suggested by the committee from the Poultry Science Association it was possible for one team to take all the cups and medals offered. At the present time in case of the Eastern District a cup is awarded to each of the three highest scoring teams, the cups ranging in size from a fifty to a seventy-five dollar cup, down to a ten-dollar cup for the fourth team. The medals for individual honors are awarded on the same basis as outlined in the rules and regulations.

JUDGING IN THE CONTEST

Fig. 188 shows the type of card which is used by the student in making his placings. Each student is given a number and that is his identification mark throughout the contest. The students are divided into groups of three, four or five depending upon the number of teams competing, and each group is assigned to a class. Two students from the same college are not placed in the same group. All students are allowed three minutes to study each class of birds before any birds are handled. The students are lined up in front of the classes they are to judge, facing away from the coops. At a given signal they face about and spend the first three minutes of the twenty minutes allowed for each class in observing the birds from the outside of the coops, using their judging sticks for the purpose of posing the birds and comparing them as to carriage and type. At the end of three minutes the birds may be removed from the coops, and the cards with the placing must be handed in promptly at the end of twenty minutes. The groups proceed in this manner from one class to another until each student has placed all the birds.

EIGHTH ANNUAL INTERCOLLEGIATE POULTRY JUDGING CONTEST

Madison Square Garden, January 23, 1925

Contestant's No.________________________

State________________________

Exhibition ________________________

Utility ________________________

Breed and Variety________________________

Placing-Band Color

1. __________________
2. __________________
3. __________________
4. __________________
5. __________________

Fig. 188.—Form of Card Used by Students in Placing Birds in a Poultry Judging Contest.

In order to avoid loss of time required to read band numbers and possible errors in reading and recording numbers a system of colored leg bands is used. This also eliminates the possibility of placing birds in wrong coops when they are returned to the coops by the students if coop numbers were to be used. Four of the birds in each class are banded each with a different colored spiral band, while the fifth bird is designated as "no band." The colors should be distinct and no colors should be used which are likely to be confused by a color-blind person. White, black, light blue and red seem to be a very desirable combination. With this system, if a bird is placed back in the wrong coop her color band goes with her and it will make no difference in the placing of the birds. In making his placings the student arranges the band colors in the order he wishes to place the class of birds.

It is very desirable that no awards should be announced until the entire group of students and coaches can be assembled together. One of the best methods of accomplishing this is to arrange for a banquet on the evening of the day on which the contest is held and make the awards immediately following the banquet. The cups and medals to be awarded may be displayed in the middle of the banquet table and are awarded by the chairman of the awards committee.

Ten teams or thirty students seem to be the maximum number which can work on one group of eight classes of birds at one time where five bird-classes are used. It is possible to handle more, but it is very doubtful if it is a wise policy to do so. By the time each bird has been handled fifty or a hundred times, as each student will handle each bird more than once, the birds are so worn out that it is impossible to tell much about type or carriage. In fact the students who handle the standard classes near the end of the contest are very much handicapped because of the condition of the birds.

JUNIOR JUDGING CONTESTS

For the past few years a great deal of interest has developed in the judging of poultry and other livestock, as well as fruits and vegetables by 4-*H* Club members and by Secondary agricultural school and agricultural high school students. The National Junior Contest held at Madison Square Garden Poultry Show each year is managed in a manner very similar to the way in which the Inter-collegiate Contest is conducted. In fact some of the same birds, especially in the production classes, are used by both contests. No written examination is required of the junior judges.

The high school and secondary agricultural school contests are usually held under the supervision of the department of poultry husbandry, at the state college of agriculture, or state department of education. The special rules governing the contest held at the New York State College of Agriculture at Cornell University are as follows:

POULTRY JUDGING CONTEST

Special Rules

1. *The Contestant.*—Each school shall be represented by one student. Each contestant will be required to place all the classes of birds.
2. *Competition.*—Only one contestant from each school will be eligible. Previous participants in farm and home week high school contests in poultry will not be eligible.
3. *Classes.*—Each class will consist of four birds. The contestants will be required to place six classes of birds for production as follows:

    S. C. White Leghorn hens
    Barred Rock hens
    White Wyandotte hens
    Rhode Island Red hens
    S. C. White Leghorn males
    Rhode Island Red males

4. *Time.*—Contestants will be allowed to start work at any time between *10:00 a.m. and 2:00 p.m.* Each contestant can continue work until all the classes are placed. There will not be a definite time allowed for each class. To avoid congestion not over 18 contestants will be allowed to work at one time. When 18 contestants are at work on the classes the incoming contestants will be required to wait until some of those at work have completed their placings.
5. *Score Cards.*—Written reasons will not be required. The birds in each class will be placed in order of merit on four separate sets of characters:

    (1) Breed and varietal characteristics.
    (2) Body conformation.
    (3) Head and temperament.
    (4) Physical condition and changes.

    Then these four placings will be brought together by the contestant into one final placing. The final grade on each class will be the average of the grades obtained on the average of the four original placings and the final placing.
6. *Awards.*—Three awards will be given to the high schools placing first, second and third. Medals will be awarded to the contestants representing the high schools receiving first, second and third places.
7. *Entries.*—Entry should be made to the Department of Poultry Husbandry, Ithaca, New York.

No written examination is required in the junior contest and the grading is done in the same manner as that followed in the inter-collegiate contest except that a table for four-bird classes is used in arriving at the score. Fig. 189 shows the score card used in the High School Contest at Cornell University.

Comparison judging is used in all contest judging. Score card judging has not been attempted as it would be impossible to use a score card for certain characters, such as type and carriage, as seen from the outside of the coop because such characters would change very materially after the birds had been handled by several contestants.

POULTRY JUDGING CONTEST

Cornell University—Farm and Home Week, February 13, 1930

PLACING

Class Judged______________ Contestant's Number______________

Indicate Order of Merit by Leg Band Color of Each Fowl

	1st	2nd	3rd	4th	Grade
Breed and Varietal Characteristics: Weight, symmetry of body shape, color markings, cleanliness and order of plumage, vigor; freedom from standard defects.					
Body Conformation: Width, length and shape of back, depth of body front and rear; heart and lung girth. Width of pelvic arch in hens and pullets.					
Head and Temperament: Nervous energy. Eye, color of comb, wattles and face; texture of skin. Masculinity of male; femininity of female.					
Physical Condition and Changes: Flesh condition, quality of skin. Pigmentation. Hens at end of laying, freedom from yellow pigment. Males, abundant yellow color. Pullets, abundant yellow color at time of first egg or before. Molt in hens. Development in cockerels and pullets.					

Total for Comparisons______________

Grade for Comparisons______________

	1st	2nd	3rd	4th	Grade
Order for Placing........................					

Total comparisons and placings______________

Final Grade______________

Fig. 189.—Score Card Used in the High School Judging Contest Held during Farm and Home Week at Cornell University.

BENEFITS FROM JUDGING CONTESTS

There are several benefits which may result from judging contests. First there is a real educational value to be derived from the training for a judging team. In addition to the regular classwork a great deal of extra work must be done in the intensive training for the team. In this work the student learns to make decisions and to place a definite value on quality. He becomes acquainted with what is meant by real production values and real standard values and is able to recognize them when he sees them. The contest, being held at one of the leading shows of the United States, provides an opportunity for students who have been able to make the team to see the finest birds that are produced in the country and the results of the methods of fitting and exhibiting them.

Another important feature is that students and coaches from different parts of the country have a chance to meet and discuss questions of mutual interest. Finally these students who have had intensive training in judging work will go back to the rural communities, in various capacities, and with their appreciation and recognition of quality values their influence will be great in raising the general level of quality in all kinds of livestock, fruits and vegetables.

CHAPTER XXI

PRODUCTION POULTRY SHOWS

EARLY POULTRY EXHIBITS

There were exhibits of poultry made in the United States as early as 1826. Most of these exhibits consisted of a few birds brought to county fairs. About 1845 a small exhibit of poultry was made at the New York State Fair at Utica. Interest in poultry created at fairs led to the first exclusive poultry show held in the United States, at the Public Garden, Boston, Mass., November 15–16, 1849. This show was much larger than expected, there being 1423 birds on exhibit. There was no definite standard by which these birds were judged and great and varied were the numerous types of fowls.

In February, 1873, poultry breeders of the United States and Canada organized the American Poultry Association and standardized the numerous varieties of domestic fowls. One year later the first edition of the American Standard of Excellence (later called American Standard of Perfection) appeared and a more and more uniform judging standard has been available ever since.

During 1925 it is estimated that about 300 major poultry shows were held in this country. The largest and most important standard poultry show in the United States is held during January of each year at Madison Square Garden in New York City. Other important shows where birds are judged for standard requirements are held each year at many of the leading cities, among the most prominent of which are Chicago, Boston, Indianapolis, Portland, Hagerstown, Syracuse and Kansas City.

PRODUCTION SHOWS

Many of the county, state and district poultry shows in recent years have been adding "production classes." The first production show ever held in this country probably was the one at the New York State College of Agriculture at Cornell University in November 1922. Since that time not only many of the big shows have been adding production classes to their catalogues but production shows are becoming very popular, especially among the vast number of farm flock and commercial flock breeders. This is especially true of those poultrymen who are specializing in the sale of breeding stock, hatching eggs and chicks.

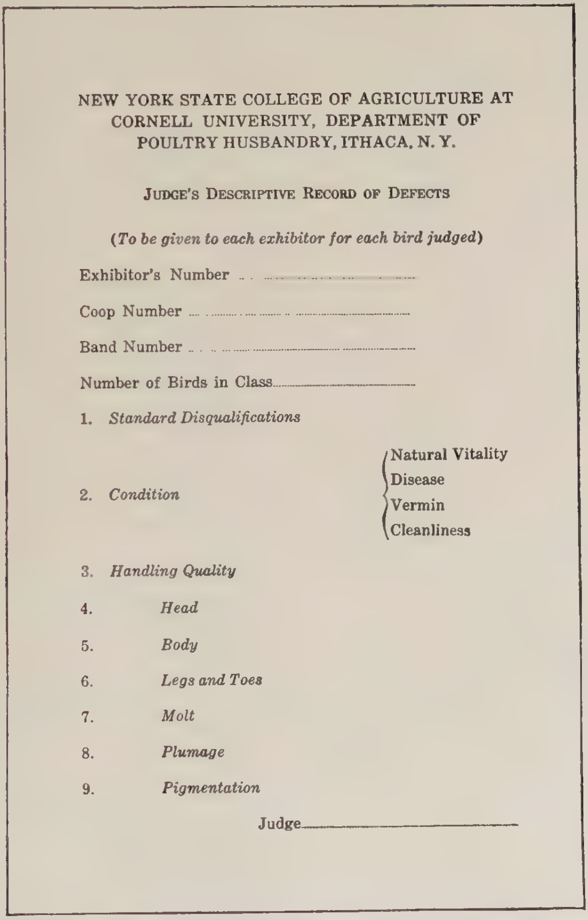
A production show provides an opportunity for exhibiting, judging, buying and selling production-bred poultry with proper consideration given also to their breed characteristics and purity of breeding. The major considerations in production judging are given to capacity for heavy production and strong constitutional vigor to stand up under heavy laying, to produce fertile, hatchable eggs and vigorous chicks, and also freedom from disqualifications as described in the American Standard of Perfection.

The holding of production shows is no longer an experiment. The first New York State Production Poultry Show, in response to the urgent request of large numbers of poultrymen, was a decided success. The fifth and last show held exceeded in numbers and interest any that had been held previously. The New York State Production Poultry Show held at Cornell University, Ithaca, for five years was conducted as a demonstration in methods of production judging as an important part of the New York State Breed Improvement Program. It served the useful purpose of creating in the minds of exhibitors and visitors the importance of demonstration judging and a proper appreciation of the production qualities of poultry. This served as a great stimulus to the introduction of production classes in the town and county agricultural fairs of the state. When many of the leading poultry shows and agricultural fairs of the state had adopted production classes and method of judging it was no longer necessary for the production show, sponsored by the college, to continue. The last show was held in 1926.

The show was promoted by the College of Agriculture to meet an important need that otherwise might not have been provided. It was conducted as a state-wide educational project in the judging of birds for egg production, for meat production, and standard exhibition qualities. It also served to promote the acquaintance of breeders and to facilitate the widest possible distribution of the best quality of poultry for breeding purposes.

The production show provides a distinct opportunity for the most progressive breeders to compare their stock and to measure their own efficiency in breeding. To those who win prizes, it is a decided financial advantage. To those who fail to win honors, positive knowledge is secured as to how to improve the quality of their birds with a view to winning in other production shows.

Features in a Production Show.—There were six distinct features to the New York State Production Show which can be carried out in any similar show. First: The judging of birds with regard to their production values and essential breed characteristics. Second: An educational judging demonstration, where the judging of all birds was done in the presence of the exhibitors, who had full opportunity to see the birds handled and to hear the reasons explained as to why all of the birds in the classes in which they were exhibitors won or lost. Third: The show-ring plan of judging and placing the final winners and sweepstake competitors was followed in each single class. The winning birds of all classes were cooped together where exhibitors and visitors had opportunity to observe them for close comparison. Fourth: Each



NEW YORK STATE COLLEGE OF AGRICULTURE AT
CORNELL UNIVERSITY, DEPARTMENT OF
POULTRY HUSBANDRY, ITHACA, N. Y.

JUDGE'S DESCRIPTIVE RECORD OF DEFECTS

(To be given to each exhibitor for each bird judged)

Exhibitor's Number ....

Coop Number ....

Band Number ....

Number of Birds in Class..........................

1. *Standard Disqualifications*

2. *Condition*
    - Natural Vitality
    - Disease
    - Vermin
    - Cleanliness

3. *Handling Quality*

4. *Head*

5. *Body*

6. *Legs and Toes*

7. *Molt*

8. *Plumage*

9. *Pigmentation*

Judge..........................

FIG. 190.—Judge's Descriptive Record of Defects. One of These Blanks Was Filled Out for Each Bird in the Production Show.

exhibitor, whether present or not, was given upon request a written statement of the outstanding faults of his birds. The judge's descriptive record of defects is shown in Fig. 190. Fifth: Each exhibitor and visitor was encouraged to accept the opportunity to listen to illustrated lectures on the subjects of breeding and selection of poultry for production. Sixth: On the last day of the show there was an exhibitors' judging contest held in order to test the ability of exhibitors to select birds for future shows.

" To make the useful more beautiful and beautiful more useful is the highest ideal of the breeder " was the slogan of the show.

Instructions and Rules for a Production Show.—The following instructions and rules are taken from the 1926 catalogue of the New York State Production Poultry Show.

1. Make application promptly on the blank form supplied for this purpose.

2. Write plainly your name, address and express office.

3. Give the name of variety, the class and number of birds entered in each class. Numbered leg bands and shipping tags will be mailed to each exhibitor.

4. Fill in the correct amount of entry fee and forward a check or money order, made payable to the Poultry Department of the New York State College of Agriculture. The fee of 50 cents per bird entered for exhibition must accompany the application.

5. No entry will be received unless accompanied by the entry fee.

6. Entries close Saturday night, November 13.

7. Birds will be received Monday, November 29.

8. The show opens Tuesday morning, November 30, and closes Friday morning, December 3. All exhibits must be in by Tuesday morning as judging begins on that day.

9. Birds will be returned on Friday, December 3.

10. Any specimen of a standard breed may be entered. All birds must be in their natural condition. The pulling of stubs, or false feathers, bleaching of feathers, removal of side-sprigs or any other method of *faking* is not permitted and if discovered will debar the exhibitor from the show.

11. Express charges must be prepaid on all exhibits.

12. Each specimen entered must be the property of the exhibitor.

13. Shipping tags, on which will be placed the exhibition coop number, will be furnished and one for each entry will be sent to the exhibitor, if the entry is received by November 15. (Fig. 191 shows type of shipping tag used.)

14. The best possible care will be taken of all birds. Competent men will be in charge at all times, but no responsibility will be assumed by the show management for any loss or damage, the birds being entered at the sole risk of the owners. The utmost precaution will be taken to prevent and safeguard all birds against infection. Every coop will be thoroughly disinfected by the dipping process before the show is held. Any bird showing signs of sickness will be isolated and cared for.

15. Specimens may not compete in more than one class; namely as single birds, in pairs, etc.

16. No exhibitors may handle any bird belonging to any other exhibitor without the consent of the owner or of the judge during the judging.

17. All exhibitors are *urged to be present* when birds in the class in which they have entries are being judged, and may also be present at other times. Every precaution will be taken to prevent the judge from knowing the owner of the birds. (This, however, is a matter of choice of most judges and exhibitors and not an essential requirement.)

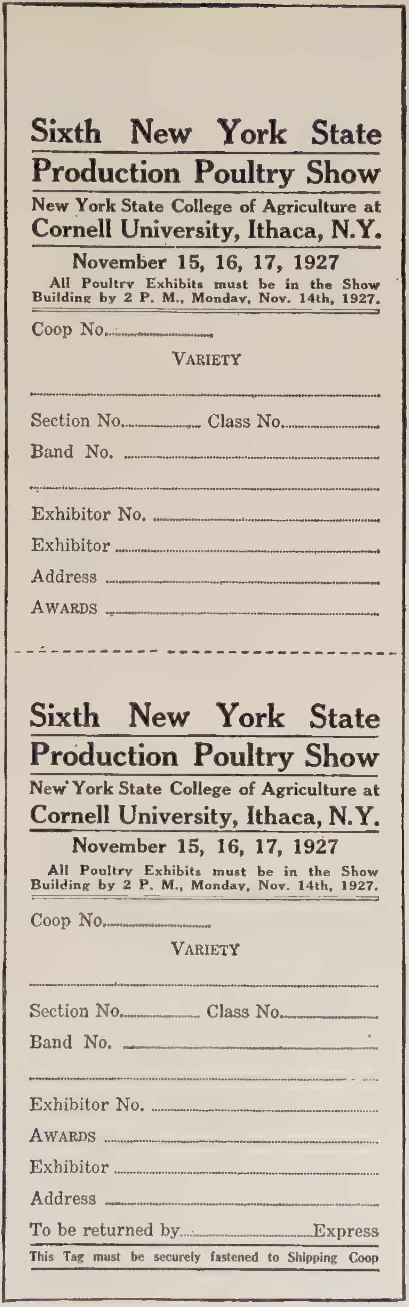
18. No names or marks other than those provided by the show authorities will be allowed on coops before the birds are judged. (This also is a matter of choice and not fundamental.)

19. Birds entered for exhibition may be advertised and sold at private sale.

20. Specially numbered leg bands will be furnished, to be placed by the owner before shipment on all birds entered for the show.

Section for 4-H Club Members.—One section of the show is closed to all exhibitors except 4-H Club members. The classes in this section are limited to singles, cock, hen, cockerel and pullet, and the birds must have been produced by the Club members showing them. No entry fee is charged and no cash prizes are offered. Ribbon awards for the first five places in each class, of each of the standard varieties, are made. A silver loving cup is awarded to the county obtaining the largest number of points on a scale of 16 for each first place won by an exhibitor from the county, 8 for each second, 4 for each third, 2 for each fourth and 1 for each fifth.

A 4-H Club Poultry Judging Contest was held during the production show. Each team consisted of three club members. The contest was conducted in the same manner as that described for high



Sixth New York State
Production Poultry Show
New York State College of Agriculture at
Cornell University, Ithaca, N.Y.
November 15, 16, 17, 1927
All Poultry Exhibits must be in the Show Building by 2 P. M., Monday, Nov. 14th, 1927.

Coop No.........................
VARIETY
....
Section No.................. Class No........................
Band No. ....
....
Exhibitor No. ....
Exhibitor ....
Address ....
AWARDS ....

Sixth New York State
Production Poultry Show
New York State College of Agriculture at
Cornell University, Ithaca, N.Y.
November 15, 16, 17, 1927
All Poultry Exhibits must be in the Show Building by 2 P. M., Monday, Nov. 14th, 1927.

Coop No.........................
VARIETY
....
Section No.................. Class No........................
Band No. ....
....
Exhibitor No. ....
AWARDS ....
Exhibitor ....
Address ....
To be returned by.................................Express
This Tag must be securely fastened to Shipping Coop

FIG. 191.—Coop Tag and Shipping Tag Used in the Sixth New York State Production Poultry Show.

Duplicate tags facilitate cooping and uncooping of birds.

ENTRY FORM

FIFTH ANNUAL PRODUCTION POULTRY SHOW,
NEW YORK STATE COLLEGE OF AGRICULTURE,
ITHACA, N. Y.

NOV. 30, DEC. 1, 2, 1926

Mail this entry to R. C. Ogle, Secretary, Poultry Department of the New York State College of Agriculture, Ithaca, N. Y. Entries close November 13th.

Name of Exhibitor .... County ....

Address..

SECTION A

Uncertified Without Trapnest Records

Classes of Poultry Uncertified	No. of Birds Entered	Class Mark X Below	Name of Variety	Legband Number	Amt. of fee 50c. per bird
1. Cock					
2. Hen					
3. Cockerel					
4. Pen old (4 hens & 1 cock)					
5. Pen old (5 hens)					
6. Pair old (cock and hen)					
7. Pair hens					

SECTION B

Uncertified With Trapnest Records

8. Cock					
9. Hen					
10. Cockerel					
11. Pen old (4 hens & 1 cock)					
12. Pen old (5 hens)					
13. Pair old (cock and hen)					
14. Pair Hens					

SECTION C

Certified Without Trapnest Records

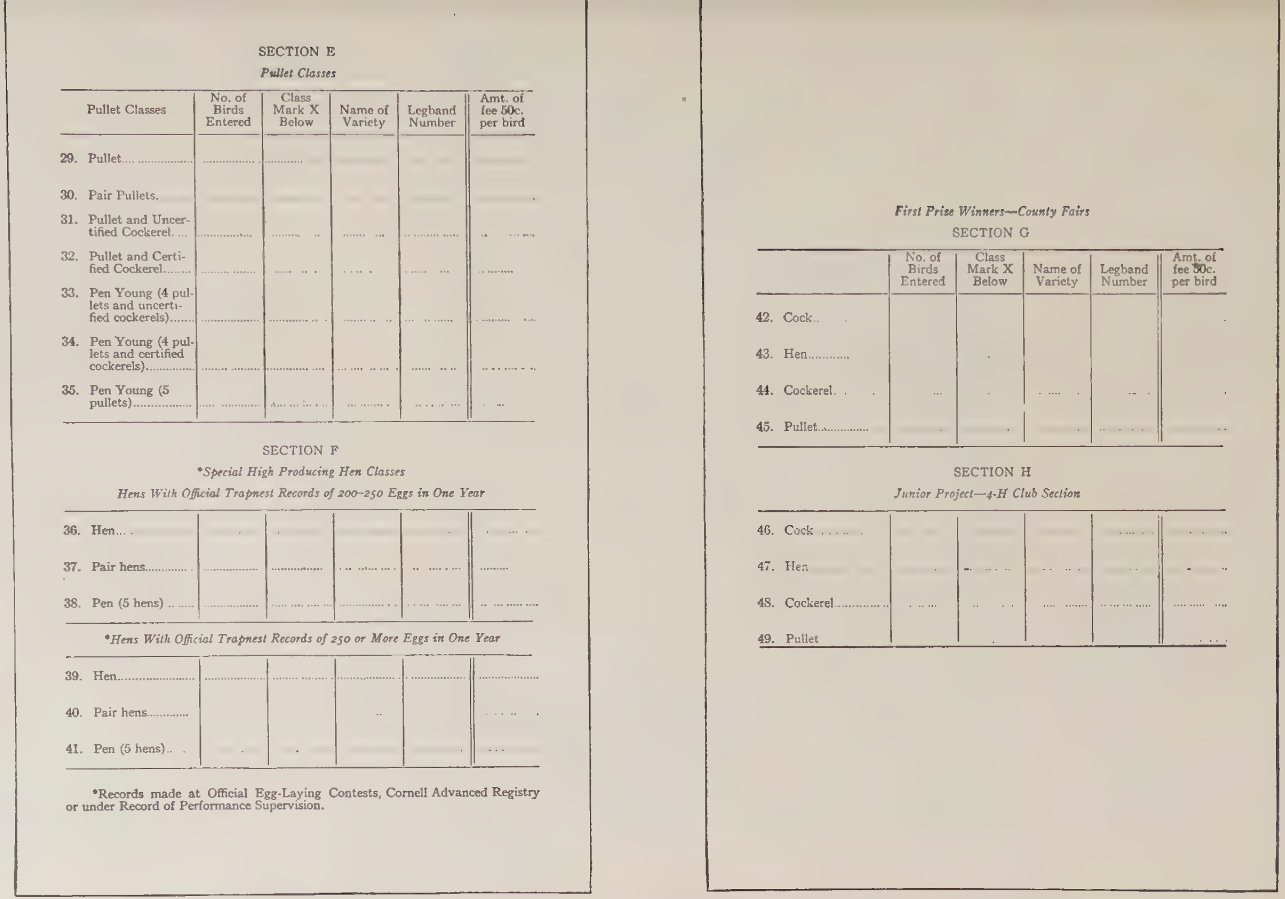
Classes of Poultry Certified	No. of Birds Entered	Class Mark X Below	Name of Variety	Legband Number	Amt. of fee 50c. per bird
15. Cock					
16. Hen					
17. Cockerel					
18. Pen old (4 hens & 1 cock)					
19. Pen old (5 hens)					
20. Pair old (cock and hen)					
21. Pair hens					

SECTION D

Certified With Trapnest Records

22. Cock					
23. Hen					
24. Cockerel					
25. Pen old (4 hens & 1 cock)					
26. Pen old (5 hens)					
27. Pair old (cock and hen)					
28. Pair Hens					

Females to be entered in THE CERTIFIED CLASS must have gone thru at least one laying season and have been certified in 1926 and males must have been certified in 1926.



SECTION E

Pullet Classes

Pullet Classes	No. of Birds Entered	Class Mark X Below	Name of Variety	Legband Number	Amt. of fee 50c. per bird
29. Pullet					
30. Pair Pullets.					
31. Pullet and Uncertified Cockerel.					
32. Pullet and Certified Cockerel					
33. Pen Young (4 pullets and uncertified cockerels)					
34. Pen Young (4 pullets and certified cockerels)					
35. Pen Young (5 pullets)					

SECTION F

**Special High Producing Hen Classes*

Hens With Official Trapnest Records of 200–250 Eggs in One Year

36. Hen					
37. Pair hens					
38. Pen (5 hens)					

**Hens With Official Trapnest Records of 250 or More Eggs in One Year*

39. Hen					
40. Pair hens					
41. Pen (5 hens)					

*Records made at Official Egg-Laying Contests, Cornell Advanced Registry or under Record of Performance Supervision.

First Prize Winners—County Fairs

SECTION G

	No. of Birds Entered	Class Mark X Below	Name of Variety	Legband Number	Amt. of fee 50c. per bird
42. Cock					
43. Hen					
44. Cockerel					
45. Pullet					

SECTION H

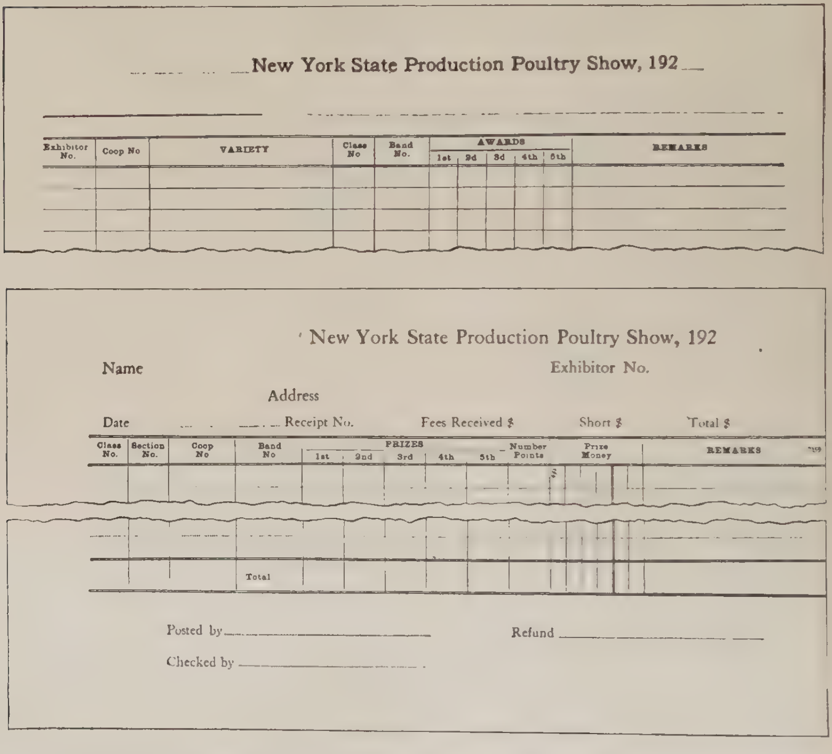
Junior Project—4-H Club Section

46. Cock					
47. Hen					
48. Cockerel					
49. Pullet					

Fig. 192.—Entry Form Used in the New York State Production Poultry Show.

school students in Chapter XX on "Poultry Judging Contests." The highest-scoring individuals in this contest were selected to represent New York State at the national contest held at Madison Square Garden, New York City.

The prizes in the regular classes are distributed on the basis of at least one-half the amount of money received from entries in each class, 50 per cent for the first prize, 30 per cent for the second prize and 20 per cent for the third. Handsome ribbons are awarded to those winning first, second, third, fourth and fifth places. The balance of the money received for entry fees, not to exceed 50 per cent, is used to purchase sweep-stake prizes, ribbons, leg bands, etc. Eight silver cups were offered in 1926 for special and sweep-stake prizes, besides a number of other special prizes.



New York State Production Poultry Show, 192

Exhibitor No.	Coop No	VARIETY	Class No	Band No.	AWARDS					REMARKS
					1st	2d	3d	4th	5th	

New York State Production Poultry Show, 192

Name Exhibitor No.

Address

Date Receipt No. Fees Received $ Short $ Total $

Class No.	Section No.	Coop No	Band No	PRIZES					Number Points	Prize Money	REMARKS
				1st	2nd	3rd	4th	5th			
			Total								

Posted by Refund

Checked by

FIG. 193.—Above, a Page from the Judge's Book and below, a Page from the Secretary's Book, New York State Production Show.

The entry form used for the New York State Production Poultry

Show is shown in Fig. 192. It will be noted that a large number of classes are provided, and in order to keep all the classes straight and get them cooped in the right order it is necessary to send a tag with the class number, leg band number or numbers and coop number for each separate entry. A great deal of detailed work is necessary previous to the show but it makes the cooping and uncooping of the birds very simple and few errors are experienced. The leg bands are in colors, with black figures on a light background, which makes them easy to read. A page from the secretary's book and a judge's book are shown in Fig. 193.

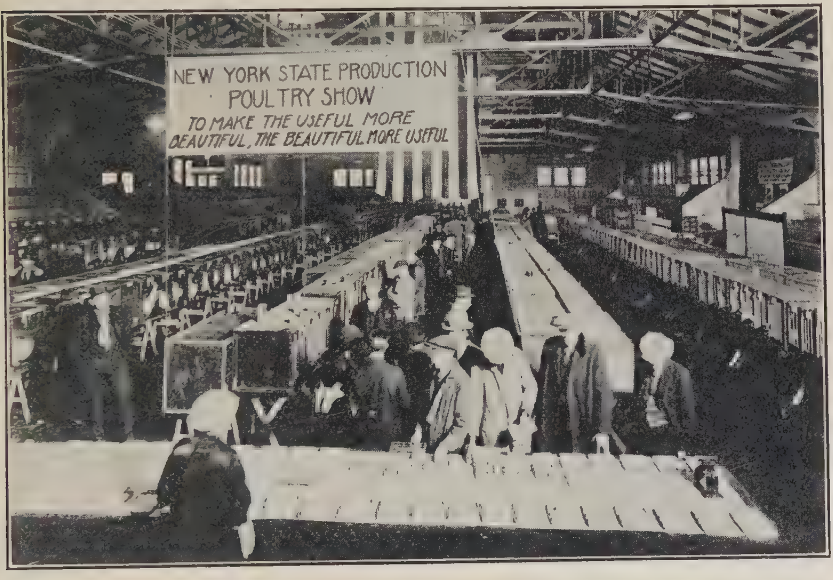

NEW YORK STATE PRODUCTION
POULTRY SHOW
TO MAKE THE USEFUL MORE
BEAUTIFUL, THE BEAUTIFUL MORE USEFUL

FIG. 194.—A Production and Egg Show Where Demonstration Judging Were Practiced.

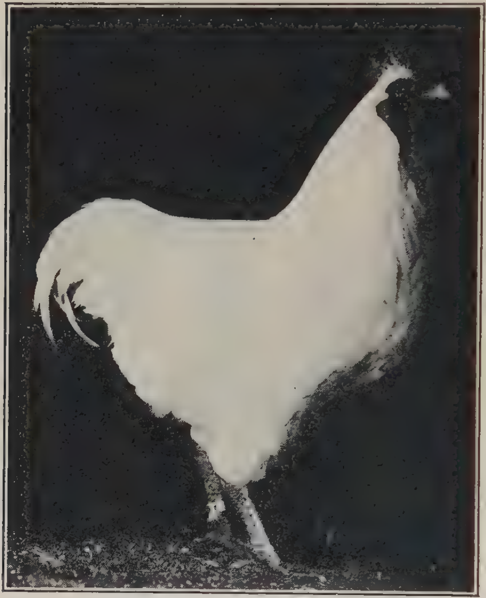
The work of staging the show was done alomst entirely by the staff of the Department of Poultry Husbandry together with the help of the winter course and the regular students taking poultry courses. This gave the students first-hand information on the methods of conducting and managing a poultry show. About 1300 birds were cooped in the 1926 production show. The judging was done by members of the Poultry Department staff.

A few helpful suggestions to observe in selecting birds for the production show were given in the premium list and rules issued several weeks before the show.

Select Birds for the Show:

1. That possess strong vitality, as shown by their size, shape of head, size and color of comb, body type, condition of plumage, color pigmentation of shanks and skin, the expression of their eyes, and by their actions.

2. That possess the true egg-laying characteristics—a strong, masculine head in the case of the male, and clean-cut strong effeminate head in the case of the female; each sex having a smooth-texture, warm, bright-colored comb, wattles and face; round open prominent bright expressive eyes which send out a challenge; wide flat backs, the width carried well back from the hips to the tail; wide between the pubic bones in the case of the female and moderately so in case of the male; deep abdominal capacity as measured from the hips to the center and rear of the keel; a moderately long keel, parallel to, or sloping away from, the back in the case of the female, and in the case of the male a deep abdomen, as measured from back to keel, less pronounced, however, than in the female. Large "heart and lung girth" as measured by the width of the body back of the wings and carried well back over the loins to the hips. The essential differences in body type of the high production male and the high production female are the greater relative capacity of the forepart of the male (as measured by width of shoulder and depth from shoulder to front of keel) and the greater relative capacity of the rear part of the body of the female as measured by the width of the back and the depth from the hips to the rear of the keel.



Bred by C. M. Christian, Horseheads, N. Y.

Fig. 195.—A Production Show Winner.

Note the strong, well-balanced, masculine head, rectangular shaped body, with good length and depth, and strong legs.

3. That show by their late quick molting and the soft pliability of the skin and abdomen that they are late persistent laying, high-producing hens.

4. That are reasonably true to important breed and variety characteristics, particularly as regards color of plumage, kind of comb, color of eye, skin and shanks (except as changed by their production), and that are normal in weight for the size of the bird.

5. That are free from deformities and defects, such as crooked keel in the male, roach-back, hump-back, wry tail (carried to one side), squirrel tail (carried forward over the back at an angle of more than 90 degrees), lopped comb in the case of males, purple comb; side sprigs and deep folds or thumb marks on the comb of the males; stubs between the toes or on the shanks of the smooth-shanked breeds and varieties; pronounced red in the earlobes of white-earlobed breeds; any white in the earlobes

of red earlobed breeds or serious white in the face of old birds and the same defects to a less extent in young birds; brassy plumage in the white varieties and distinctly foreign color in any bird.

6. That are free from scaly leg and body lice and are not suffering from disease or injuries. Strive to secure uniformity in size and quality of the birds to be shown in pairs and in pens.

Birds should be shown in their natural condition in order that they may be judged accurately. This means that they should be reasonably clean, naturally, and they need not be washed except their shanks and feet. They should not be bleached, scoured, plucked or "dolled up" in any other manner. They will be judged primarily for their true inside quality, more than for their superficial, madeup outside quality. The production value of the birds will be the main consideration in judging, although essential breed characteristics will be given proper attention.

Fig. 196.—Close Competition in Certified Class of S. C. W. Leghorn Cockerels, New York State Production Show.

The Pennsylvania State Standard Production Poultry Show paralleled very closely the New York State Production Show. Birds which place in that show must not only satisfy the requirements of the fancier judge or the production judge but must be acceptable to both. It is this fact which gives the Pennsylvania State Show the unique position which its holds. "Beauty and utility" is the slogan of the show.

More and more, production classes in the poultry shows are being demanded by poultrymen throughout the United States and the demand for the services of trained production judges who know real production values as well as standard values is rapidly increasing. Many poultry departments are cooperating with state poultry associations and county and state fairs in staging production and exhibition poultry shows. The majority of the production classes at these exhibitions are judged by college or experiment station poultry extension specialists.

THE AUCTION IN CONNECTION WITH A POULTRY SHOW

Many poultrymen desire to sell birds which they have exhibited at a show. The auction method of sale has been tried at many shows but has never proven very successful. Fig. 197 shows an auction in progress at a production show. The success of any auction depends not alone upon the number of persons who have products for sale but upon the number of prospective buyers and their willingness to buy. At a poultry show the exhibitors or persons who have birds for sale far outnumber the prospective buyers and there is little demand for exchange of birds between exhibitors; therefore in most cases bidding is slow and few sales are made. Since the exhibitors are present most prospective purchasers desire to meet the exhibitors personally and in this way many private sales are made. This is the most desirable type of sale.

FIG. 197.—An Auction in Progress at a Production Show.

The show management may be of service to the exhibitors by referring to them prospective buyers and by keeping on hand a quantity of shipping coops which the exhibitors may obtain at cost. Arrangements for shipping the birds may be made with the show management by the purchaser.

CHAPTER XXII

ORGANIZATION FOR POULTRY IMPROVEMENT

THE economic importance of poultry improvement to the poultrymen of the state and nation is so great that many organized efforts have been developed for its advancement. All of these poultry improvement agencies and projects involve directly or indirectly the judging of birds both for breed characters and for production, by physical examination.

INTERNATIONAL, NORTH AMERICAN AND NATIONAL ORGANIZATIONS FOR POULTRY IMPROVEMENT

INTERNATIONAL

1. The World's Poultry Science Association. A worldwide organization of teachers, investigators and government officials in the field of Poultry Husbandry, publishes the "International Review of Poultry Science."

NORTH AMERICAN

2. The American Poultry Association (North America). The oldest organization of poultrymen; primarily a breeders' organization devoted to standard bred poultry. Authority for the admission of breeds of poultry to standard recognition. Promotes poultry shows and exhibitions, passes upon the qualifications of standard judges, certifies poultry and acts in many capacities for the poultry breeders of the United States and Canada. Publishes the "American Poultry Association News," and the American Standard of Perfection describing and illustrating standard breeds and varieties of poultry.

3. The International Baby Chick Association. (North American in name but primarily the United States.) The largest organization of poultrymen in the United States, promotes the welfare of hatcheries through a house organ, the " International Baby Chick News" and by active participation in many projects having to do with Legislation, express and postal rates, claims and insurance.

4. "The Poultry Science Association" (North American). The membership consists of persons engaged in the teaching, research, administration and regulatory work of the Agricultural Schools, Colleges, Agricultural Departments of the State and Federal Governments of the United States and Canada. House organ, "Poultry Science."

NATIONAL

5. The "National Poultry Council." Its purpose is a "union of poultry interests of the United States of America." A nation-wide State organization having delegate representation of National and State organizations, promotes welfare movements

for the benefit of the poultry industry such as State and National Legislation poultry and egg consumption campaigns, standardization of terminology. Participation in World's Poultry Congress. Publishes reports and informational bulletins.

6. U. S. Egg Society. An organization national in scope, managed by a self perpetuating board of governors at large from widely separated sections of the United States and representing many phases of the poultry industry. The chief function is in the field of marketing. Publishes the "Egg and Poultry Magazine."

7. The Standard Poultry Breeders Association. Similar in purpose to the American Poultry Association but does not publish a standard.

8. National Breed Specialty Clubs. There are many of these organizations to promote the interests of their representative breeds and varieties such for example, are the American White, Brown, Buff and Rose Comb Leghorn Clubs, the American White, Buff and Barred Plymouth Rock Clubs, and Rhode Island Red Club of America.

Several of the Clubs have their own "house organs" and are active in development of special show meets and awards.

The "American Record of Performance Council." This organization is made up of State representatives of official Egg Laying Contests. It decides rules governing the Contests.

9. National Poultry Judges Association. Organized to promote the interests of its members who are poultry judges.

National Allied Industries

In addition to the organizations that are primarily functioning in education, research, administration and regulation within the field of Poultry Husbandry there are several National Organizations which through the activity of their individual company memberships carry on important research and extension projects. Among these organizations are the American Incubator Manufacturers Association and the American Feed Manufacturers Association, National Poultry Supply Manufacturers Association.

Dominion of Canada

The "Canadian National Poultry Record Association." National in scope, cooperates with the Dominion Government in conducting Egg Laying Contests and the publication of a Blue Book containing official records.

Poultry Judges Association of Canada.

The national poultry improvement projects which are most significant in their scope and results include ten projects: (1) Culling, (2) supervising (or "accrediting"), (3) certifying, (4) record of performance, (5) egg-laying contests, (6) 4-H club work for boys and girls, (7) home flock records, (8) disease eradication, (9) poultry shows and fairs, (10) egg and poultry inspection service. These all call for thorough organization for aggressive action. The ten projects are shown in Table 36 where an attempt is made to correlate the administrative relationships with state and national agencies.

The full significance of the specific movements for poultry improvement cannot be estimated alone in terms of the number of birds handled or by the quality of the standards set. The real measure of results is the progressive influence of all of these projects upon the final selection of breeders, proper mating and record keeping, and their combined effect upon the improvement of the offspring.

The six main objectives of all organized efforts for poultry improvement are: first, economic, by the elimination of unprofitable birds; second, breeding by increasing the quality of the stock; third, health through sanitation; fourth, uniformity of quality by standardization; fifth, education by publicity; and sixth, cooperation by organization. All of the many poultry improvement programs call for the effective cooperation of numerous state and federal agencies, poultry organizations, the allied industries and progressive far-visioned poultrymen.

These agencies may be classified as official, semi-official or unofficial, depending upon whether the inspections and other services performed are administered by state or federally supported institutions or by organizations or by individuals.

The official agencies may be grouped according to their responsibilities into: (1) educational and (2) regulatory.

These agencies do not function in the same manner in the different states and countries owing to a lack of coordinating agencies to bring about a proper uniform standardization of methods of administration.

The national plans for poultry improvement which have been adopted in various countries, though similar in the principles taught and the practices followed, differ in their plans of organization and methods of administration. This difference is due primarily to the form of government under which the poultry projects are administered. Some countries place large responsibilities in centralized authority. The administration therefore is from the top down, that is, the central dominion or national government precedes and usually dominates the provincial or state governments in matters relating to agricultural policies. In other countries the initiative and responsibility for administration rest largely with the smaller governmental units, the states or provinces. The former type of government is more paternalistic; the latter is more democratic. Whatever the form of government may be, the poultrymen are vitally concerned in securing just consideration in matters of legislation and policies of administration.

The liberality of many states and countries in their appropriations and their efficiency in administering them is largely responsible for the greater progress and consequent greater prosperity of their poultrymen. The only hope for the poultrymen in securing just recognition in any country lies in two directions, each one depending upon the other. These are education and organization. The industry must save itself.

In the main the division of responsibilities of the various agencies may be stated as follows:

The official administrative agencies in the United States are: (1) the federal department of agriculture, which handles interstate regulatory, research, and extension responsibilities; (2) the state departments of agriculture, which administer regulatory and extension responsibilities; and (3) the agricultural colleges and schools, which are responsible for resident teaching, research and extension.

The semi-official agencies are poultry organizations. The unofficial agencies are individual poultrymen, editors and publishers.

Table 36 roughly pictures the functions of the agencies having charge of the numerous poultry improvement projects.

Success in the promotion and conduct of poultry improvement projects depends upon the efficient cooperation of the many local, state and national agencies. Their responsibilities are not as a rule defined by hard and fast lines but are more or less interlocking. Each, therefore, must support, cooperate with and coordinate harmoniously with the others if the most satisfactory results are to be secured.

The agencies, their functions and administrative responsibilities for poultry improvement in the United States are, for the sake of simplicity of discussion because of a complex relationship, grouped under eight divisions: (1) Individual poultrymen, (2) poultry organizations, (3) agricultural educational institutions, (4) veterinary educational institutions, (5) state departments of agriculture, (6) the federal department of agriculture, (7) the poultry and agricultural press, (8) the publishers of poultry books.

The responsibilities which are handled by these eight agencies differ so materially in the various states, provinces and countries that space does not permit a detailed discussion of them. A brief statement regarding each of the ten poultry projects will serve to explain the principal relationships.

(1) *Culling.*—The term implies the elimination of unprofitable birds. There are many ways of handling culling projects. Individual poultrymen and hatcheries do their own culling. Poultry hatchery organizations frequently perform the culling or so-called " accrediting " service cooperatively. County agricultural agents, schools, colleges and departments of agriculture frequently handle the culling projects. The value of the culling depends upon the thoroughness with which it is done and this varies between the widest extremes in different states and by different agencies.

(2) *Supervising or Accrediting.*—These two descriptive terms are grouped together because they represent the practice of selection based

TABLE 36

The Agencies, Their Functions and Administrative Responsibilities for Poultry Improvement in the United States

Agencies	Functions	Administrative Responsibilities for Poultry Projects
(1) Individual poultrymen	Directing breeding operations (unofficial)	(*a*) Culling (*b*) Selecting (*c*) Trapping (*d*) Pedigreeing (*e*) Advertising
(2) Poultry organizations	Extension: regulatory (semi-official)	(1) Culling (2) Supervising and accrediting (3) Certifying Also (9)
(3) State agricultural educational institutions	Resident teaching; research extension (official)	(4) Record of performance (5) Egg laying contests (6) 4-H clubs (7) Home flock records Also (2) and (3)
(4) State veterinary colleges and departments	Resident teaching; research extension (official)	(8) Disease eradication
(5) State agricultural departments	Regulatory extension (official)	(9) Poultry shows and poultry exhibits and fairs (10) Egg and poultry inspection service Also (1), (2), (3), (4), (5) and (8)
(6) United States Department of Agriculture	Research; extension; regulatory (official)	(1) (6) All in extension (2) (7) (3) (8) (4) (9) (5) (10)
(7) The Poultry and Agricultural Press	Extension advertising (unofficial)	(1) (6) All in extension (2) (7) (3) (8) (4) (9) (5) (10)
(8) Publishers of poultry and agricultural books	Extension advertising (unofficial)	(1) (6) All in extension (2) (7) (3) (8) (4) (9) (5) (10)

upon physical examination. Supervising implies the individual handling and banding of each bird retained as a breeder. In some instances, the same practice applies to "accrediting" but in others it means merely the retention for breeders of all of the birds not culled and does not involve individual examination and banding. These projects are handled by the same agencies as culling.

(3) *Certifying.*—This word is used to represent so many different degrees of quality that it does not signify any definite grade in the many states where it is used. In all instances the method of selection for certification is based upon individual handling and selection by physical examination. In some states the certified grade is based on the most rigid selection of a few of the large, persistent laying, high vitality birds which are free from standard disqualifications. In other instances the whole emphasis is placed on vigor and standard qualities. Some states require mating certified flocks with unofficial or official record males from dams laying 200 eggs or 225 eggs or more.

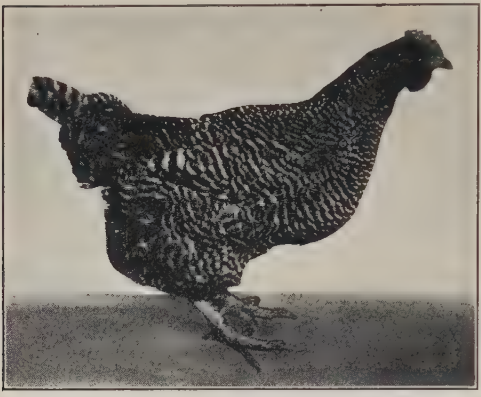


Fig. 198.—A Typical Canadian Registered Barred Plymouth Rock Hen.

She laid 321 eggs, 26 oz. per doz., 389.1 points, at the Dominion Experimental Farm, Agassiz, B. C. contest, in one year. She has a rugged-refined head, long back, well developed abdomen and an alert expression.

The wide contrast in quality of stock, eggs and chicks sold under the terminology, Supervised, Accredited and Certified makes it necessary to know before purchasing just what is involved in producing the grade advertised. Here again terms are deceptive because they do not as a rule give any guarantee of the rigidity with which the supervising, accrediting or certifying has been done. These admissions of weakness emphasize the importance of standardization and official inspections for the protection of buyers and producers alike.

Fig. 199.—Members of the Michigan Record of Performance and Guests.

Certification in most instances is administered by the official agencies.

(4) *Record of Performance.*—Although following egg-laying contests in the order of chronological development, the record of performance logically should precede the contest as a poultry improvement project. This is because home trapnesting is the best possible means of educating the owner in the knowledge of how to judge birds for production by physical examination. It also enables him to select birds on the basis of their performance before sending them to a contest and to have the further benefit of knowing the pedigrees of birds by progeny testing. The record of performance project must, of necssity, be administered by an official agency. Usually this is the college of agriculture; occasionally it is by the Department of Agriculture. The states and provinces carrying on record of performance work are:

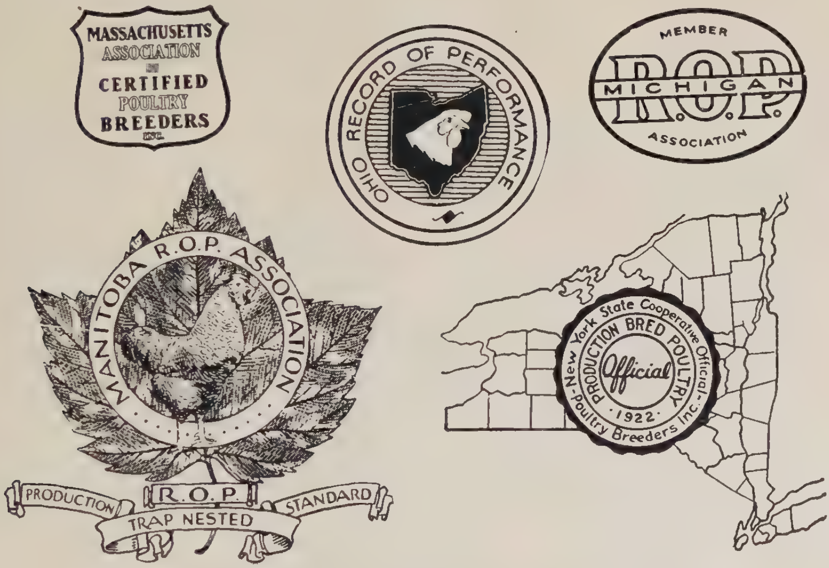

MASSACHUSETTS
ASSOCIATION
CERTIFIED
POULTRY
BREEDERS
INC.
OHIO RECORD OF PERFORMANCE
MEMBER
R.O.P.
MICHIGAN
ASSOCIATION
MANITOBA R.O.P. ASSOCIATION
PRODUCTION
R.O.P.
STANDARD
TRAP NESTED
New York State Cooperative Official
PRODUCTION BRED POULTRY
Official
1922
Poultry Breeders Inc.

Fig. 200.—The Official Emblems of Five Prominent Poultry Breeding Organizations.

Efficient organization and high standards of poultry improvement justify the adoption of emblems. They offer an opportunity for originality and beauty of design.

TWENTY-FIVE STATES HAVING RECORD OF PERFORMANCE ORGANIZATIONS

Connecticut
Delaware
Georgia
Indiana
Iowa
Kansas
Kentucky
Massachusetts
Michigan
Missouri
Nebraska
Nevada
New Hampshire
New Jersey
New York
North Carolina
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
Tennessee
Texas
Virginia
Washington

RECORD OF PERFORMANCE ORGANIZATIONS IN CANADA

Canadian National Poultry Record Association

Provincial Associations in:

Alberta
Manitoba
New Brunswick
Ontario
Quebec
Saskatchewan

(5) *The Egg-laying Contest.*—One of the most far-reaching movements for the improvement of the laying quality of poultry of the world is the constantly increasing number and improvement in methods of managing egg-laying contests.

The first egg-laying competition was held in Europe. It is significant and most appropriate that the first egg-laying competitions as a poultry breed improvement project should have been started in England. The English have earned the right to the distinction of being our greatest race of livestock breeders. This is not the time or place to prove the justification for thus giving credit in the superlative degree for a world contribution. One needs, however, only to consider how many of the names of famous breeds of every kind of livestock including many breeds of poultry, bear the names of towns and shires of England.

The first official egg-lying contest held in the United States was at Storrs, Conn., in 1911. The growth of the movement until recent years has been comparatively slow. This was due to many causes which were inherent in the conditions surrounding the management of contests. It has required many years to overcome the natural handicap of assembling and managing in each contest 100 flocks from almost as many different parts of the world, and representing many breeds and varieties, and methods of breeding and care. Marked improvements in methods of feeding and sanitation have greatly reduced mortality and increased production.

Among other factors responsible for the slow expansion of the egg-laying contest idea in this and other countries has been a lack of appreciation on the part of the poultry breeders of the values of the contest, and this in turn has affected the financial support by the poultrymen and is again responsible for a lack of financial support by the states. It was largely for this reason that many contests have depended upon the financial assistance of individuals, institutions and organizations for their establishment and partial support, for either philanthropic or business reasons or both. Great credit is due those individuals and institutions who have persisted year after year to maintain contest plants under most trying financial conditions until the idea finally has proved itself and won public approval. Now several states and provinces are providing adequate financial support.

Fig. 201.—A Partial View of the First Official Egg Laying Contest in the United States.

This is located at Storrs, Conn.

The Home Record of Performance Promotes Egg-laying Contests.—With the newer knowledge of the importance of trapnest records, pedigree hatching and progeny testing in order to make the surest and most rapid progress in breeding for egg production, there has come a larger demand for official contest records in order to secure official records of birds for breeding pens. This demand has been greatly hastened by the advent and sensational development of Home Record of Performance projects. The home record of performance instead of detracting from the support of the egg-laying contests actually contributes directly to their expansion. Home trapping is a feeder for egg-laying contests. This is true for two reasons: First, home trapnesting has the best possible educational value to those who do the trapping and keep the records. By handling the birds in the trapping pens each day in the year, one acquires the skill to recognize the difference in the appearance and the "feel" of the birds having all of the ranges of quality from the lowest to the highest. The greatest value perhaps of trapnesting is the favorable reaction, the intellectual incentive of learning to admire and appreciate true production quality and to abhor the lack of it.

The natural result of this self education and inspiration is to establish higher and higher ideals of quality and a desire on the part of the breeder to measure his breeding accomplishments with others under the standardized conditions to be found in our best-managed, up-to-date contests. Moreover, the great advantage which the trapnest breeder has acquired over his competitor, who must depend entirely upon his less expert knowledge of how to pick contest winners by physical examination results only in better contest records and hence stimulates the desire to enter better birds in more contests.

Standardization of Contest Management Promotes Improvement.—Another potent reason responsible for much of the growing demand for privileges offered by modern egg-laying contests is the recent awakening of those responsible for contest management to the necessity for standardization of rules governing entry requirements, methods of keeping records, of reporting them, and the policy of awarding prizes. It is significant also that with more uniform standardization has come a raising of standards to higher levels.

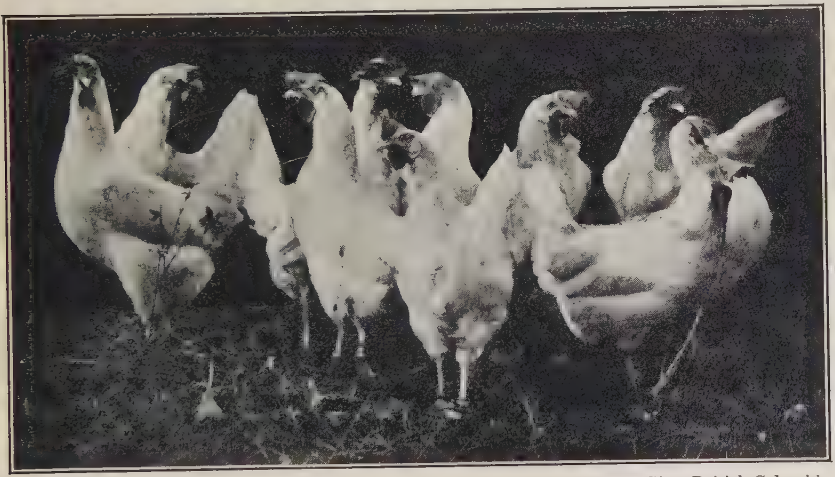
It was most natural that at first the chief and almost only emphasis should be placed upon egg production as measured by the numbers laid, as the basis of awarding honors. If the contest records and winnings are to be a fair reflection of the breeding value of birds it is becoming clearly apparent that it is unwise to continue the policy of using the number of eggs laid as the only consideration. Many of the winning contest pens making high-egg records and occupying the limelight of national publicity, if they had been used in a properly selected breeding pen, would prove to be a damage instead of a benefit to the owner from the standpoint of producing profitable stock.

The growing demand for superior egg quality as regards size, shape and uniformity of color has brought about a concerted movement toward the adoption of a proper point system of determining production values.

This recognition of egg quality in a definite plan has resulted already in causing the breeders entering birds in egg-laying contests to reorganize their matings completely in order to produce a crop of pullets laying a superior quality of eggs without sacrificing too much in their prolificacy.

The next big advance will require the publication of the weights of the contest birds in order to place proper valuation on a factor which at least is of equal importance to egg quality and high production if the influence of weight of parents upon the size of offspring is considered.

One more quality needs special consideration. It is reasonable to predict that the day is near at hand when the public will approve a policy, which has been tried and discontinued, of judging all of the contest birds on the basis of their trueness to breed and variety characteristics. This policy if sensibly handled would do much to speed up the elimination of undesirable birds from egg-laying contests. It is not sufficient to debar disqualified birds. There are wide differences in standard qualities which the public has a right to know.



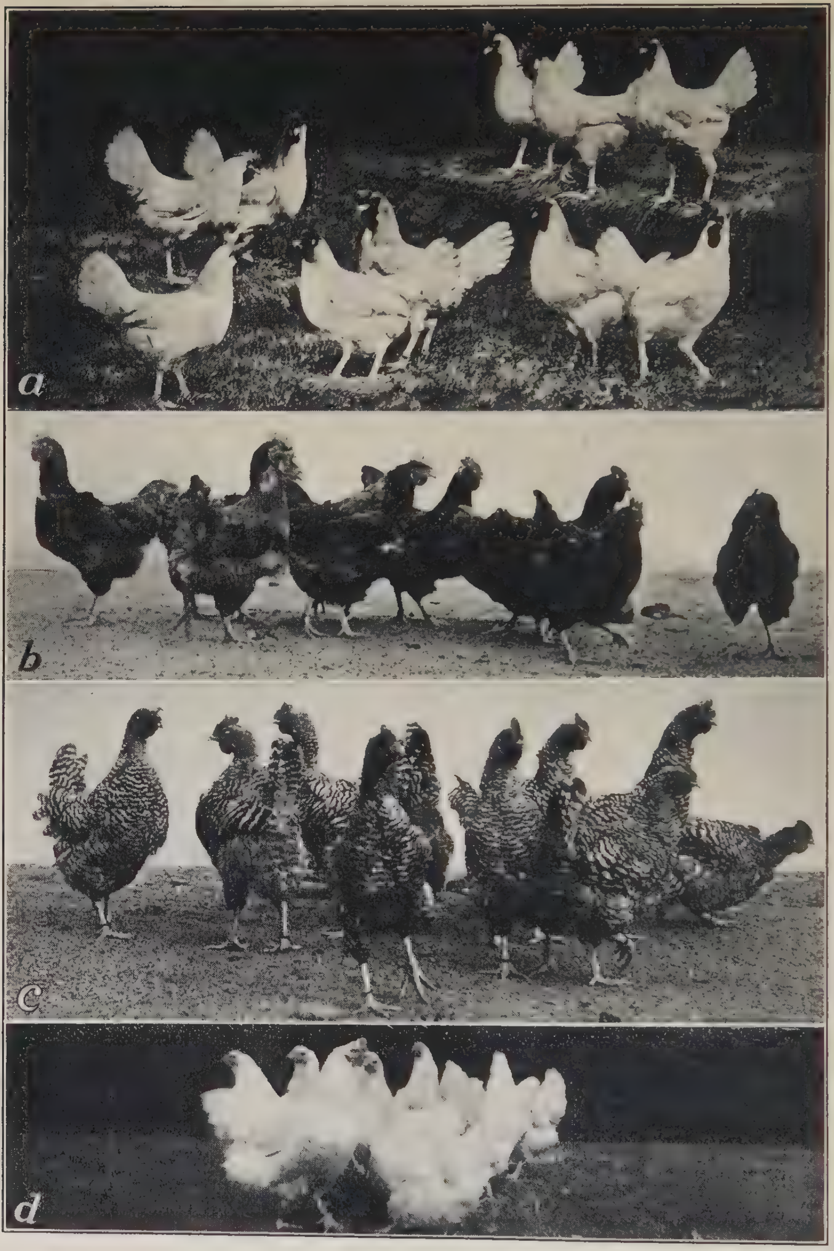
Courtesy Appleby's Poultry Farm, Mission City, British Columbia.

Fig. 202.—This Is a High Record Ten-bird Pen.

Their record was 2556 eggs or an equivalent of 304 eggs per bird weighing 24 oz. per doz. Note the large, rugged-refined heads, and the splendid large capacity bodies. They are modern type "egg machines."

Stating that birds which have standard disqualifications will not be awarded prizes, as frequently is done by the contest management, and the barring of disqualified birds aids improvement in this direction, and therefore is helpful in greatly improving the standard quality of the birds entered. This, however, does not fully meet the situation. It does not give the public complete information as to how the flocks differ in their standard breed and variety characteristics.

The reason why the policy of scoring all birds at egg-laying contests has not become popular is the fact that several money-making factors



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were of greater importance than the breed and variety refinements. The number of eggs laid, and the quality of the eggs must first be bred into the birds before much attention could be paid to the finer points of trueness to standard requirements. In other words, there were not enough high-producing birds in the country, until recently, to fill the contests that could meet standard requirements.

Even now many of the contest winners would not score high on exhibition quality. Moreover, in the case of some of the more popular breeds and varieties, the standard requirements were positively contradictory to the contest requirements, that is, the standard type differed materially from the type of the contest winners. Now that these high qualities are each year becoming more and more appreciated and the number of great performers in many breeds are being developed the standard makers have proper models on which to make standards. Fortunately the essentially artificial " cut and try " method of standard building has resulted in standard types which apparently are not at variance with the highest production quality. Such, for example, may be true of the Rhode Island Red and Plymouth Rock breeds. The standard Leghorn certainly and the standard Wyandotte probably do not consistently make the highest records. They are in marked contrast to those which usually make the highest records at egg-laying contests. The production breeders have long recognized these differences and have continued to move steadily forward in breeding and selecting for performance. The standard breeders and standard makers must eventually do the same and are doing so.

The scoring of all contest entries by judges who are highly qualified in both standard and production qualities is one of the most potent

Courtesy J. A. Hanson, Corvallis, Ore.

Fig. 203*a*.—A World's Record Pen of Single Comb White Leghorns.

These ten original hens laid 2989 eggs in 365 days at the Storrs Contest. Seven out of the ten laid from 302 to 320 eggs, a world's record for number of 300-egg hens from a pen of ten original birds. These ten birds came from stock which on the female side for three generations were birds laying over 260 eggs, while the sires were all of 300-egg breeding.

Courtesy John Z. LaBelle, Ballouville, Conn.

Fig. 203*b*.—World's Record Pen of S. C. Rhode Island Reds, Storrs, Conn., Egg-laying Contest, 1929.

These birds laid 2657 eggs in 51 weeks.

Courtesy Robt. C. Cobb, Old Pickard Farm, Littleton, Mass.

Fig. 203*c*.—A World's Record Pen of Barred Plymouth Rocks.

The ten original birds laid 2755 eggs in one year. This is a world's record for all heavy breeds (10 birds in a pen) where the score is computed on the ten original birds.

Courtesy Gustav Wolfram, New Hamburg, N. Y.

Fig. 203*d*.—Winning Pen of White Wyandottes at Storrs, Conn., Egg-laying Contest, 1929.

These birds laid 2302 eggs.

methods of bringing about perfect harmony of ideals in judging and breeding. The poultry industry is now gradually giving more attention to the perfection of breed characters. There are enough birds in the country now to meet fully the qualifications of (1) high production, (2) superior egg quality, (3) total production points, (4) body weight and (5) freedom from standard disqualifications; therefore the public is entitled to know the sixth qualification, namely, the standard score of each bird in a contest pen.

A serious limiting factor in the development of the egg-laying contest has been the exploiting of contests by jobbers in contest birds. By a " contest jobber " is meant a person, who, largely for advertising purposes, purchases stock to enter in egg-laying contests instead of breeding and growing the birds he enters. Just in proportion as this abuse of the privileges of egg-laying contests is permitted, the public will be suspicious of contest records as officially representing the highest of breeding value. Although some may argue, with some justification, that the contest is a measure of the value of birds and not of men, nevertheless one necessarily must reflect the value of the other. The policy to be followed with regard to requiring guarantees of " breeder responsibility " for breeding each entry will depend largely upon whether chief emphasis is to be placed upon a contest as a race

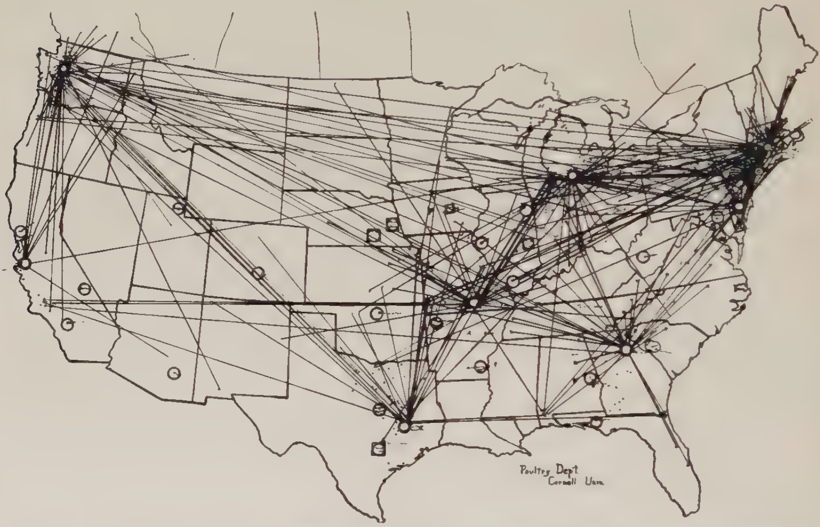

FIG. 204.—Egg Laying Contests Draw Their Entries not Only from All Sections of the United States, but also from Canada and Many Other Foreign Countries as Illustrated in This Figure.

course for advertising purposes, or upon the greater value as an official breed improvement project in which the skill of the breeder is the main consideration. It seems inevitable that the latter view will prevail. If not, then the official Home Record of Performance records will come to have greater value than official contest records because the former will largely reflect the breeding quality which the whole breeding flock represents, whereas the contest flock is only a specially selected sample of the poultryman's best breeding or skill in buying. The public has a right to know which. If the contestant is to be allowed to buy the result of the skill of another and better breeder, the public receives an entirely erroneous impression of values. This fact makes it necessary for the records of egg-laying contests to reflect the skill of a breeder rather than the purchasing ability of a "jockey" contest race winner.

The contest "jockey" can be compared, appropriately, to the "stringer" exhibitor at the fairs who, in many instances at least, purchases his string of birds for exhibition and replenishes his exhibit as he goes from show to show, and with the result of discouraging the bonafide breeder from attempting to compete. So long as contest managements do not erect proper barriers to protect the public and the best breeders from those who buy their entries as a substitute for their own inability to produce winners, the contest will fail to measure up to their full obligation to the industry. The contests should be an impartial, official tribunal—a court of last resort whose record attempts to accurately report and reflect a breeder's skill.

Fig. 204 illustrates the range of influence of egg-laying contests. The radiating lines from several prominent contests show how they draw entries from many other states. The long intersecting lines indicate how hundreds of flocks of the most promising pullets are moving each year from every state in the union to nearby and distant points to compete in official egg-laying contests.

As an official register of breeder accomplishments the properly organized and administered egg laying contests occupy a place of distinction and great influence in improving the quality of poultry of the world.

THE FUNDAMENTALS OF EGG-LAYING CONTESTS

It would appear, after the experiences of years of contest management in the United States and Canada, that certain underlying principles of management can be stated. These named, in so far as this is possible, in the order of their importance are: (1) *Honesty, accuracy* and *completeness of records.* Without these there could be no justification for the existence of contests. Confidence in the impartiality and reliability of contest management is the first and major consideration. This is the chief reason why the contests should be official—that is, administered by some properly constituted state authority. It is greatly to the credit of contest managements that almost without exception it has been free of just criticism in this respect.

(2) *Health and Safety of the Birds.*—Certainly the importance of this factor cannot be over-estimated. The loss of even a few of the best birds not only in itself is a great loss but the loss of rating in the year's record may be quite as serious. The problem has been one of the most difficult to handle on account of the bringing together of many flocks each year from many widely separated parts of the country. Modern methods of sanitation and management have done much to overcome the mortality handicap but there is still room for much improvement.

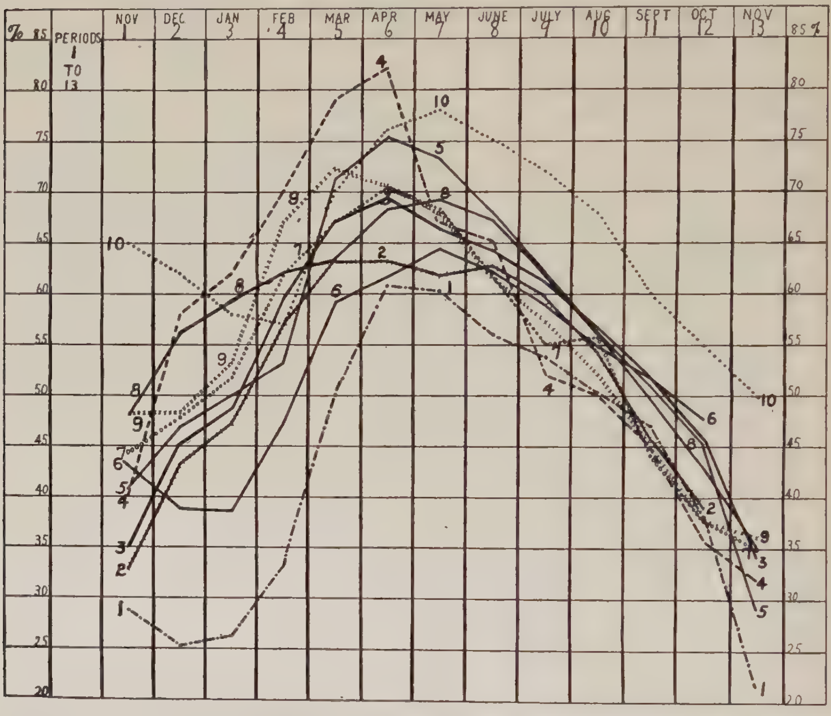

FIG. 205.—This Graph Shows the Variations in the Curves of Production for Ten Egg-laying Contests Located in Widely Scattered Sections of the United States.

(3) *Most Efficient Production.*—Here the management, as well as the birds, is on trial. A study of the monthly production records of ten leading egg-laying contests in 1928, shown in Fig. 205, illustrates to

what extent the personal equation enters into the results. Since the contests in question are located in widely separated parts of the United States, covering each of the principal regions, it might have been assumed that the climate may have been responsible for the widely different results.

Such, however, does not appear to be the case, since some of the contests show decidedly different results in other years. The facts, however, indicate that the factor of management is chiefly responsible for results. Management is rapidly improving and is responsible, for a part at least, of the steady increase in annual production at the contests in recent years. Better methods of breeding and selection no doubt are responsible for at least half of the steady climb in production.

(4) *Proper Publicity of Results.*—There has been a steady and marked improvement in the methods of keeping the records and of tabulating the results for the information of the contestants and the public. Each year the press has given more attention to contest reports and the offering of valuable prizes for contest winners. The demand of the press is a potent force to bring about proper standardization of methods of reporting results.

The advantages accruing from the establishment of the contests are many and important. Some of these are:

(1) They provide official standards of measuring the laying qualities and breed characteristics of birds under uniform and impartial conditions of management.

(2) They return to the owner many breeding birds with official egg records for pedigree breeding and progeny testing. These contest record birds supplement his own home record of performance birds for pedigree breeding or provide him with contest record birds without the necessity of home trapping, except perhaps at the hatching time.

(3) They enable breeders and other visitors to see the birds from approximately 100 farms at each contest, many of which will be among the best in the country.

(4) Valuable data may be secured regarding costs of production of different breeds and strains.

(5) They serve as demonstration plants where the most approved methods of feeding, sanitation and house management are to be seen.

(6) The contests attract thousands of visitors annually. The birds and their records provide a great sales advantage to the breeders of superior birds, even though they should not be contest winners.

The proof of the need for these contests is shown by the fact that many of the contests are booked up each year long before the contest starts.

The poultrymen of any state should count themselves exceedingly fortunate in case the state authorities have had the wisdom and generosity to grant the funds for the establishment of an up-to-date contest. It is now universally agreed that they provide exceptional opportunities for the poultrymen to maintain and improve the quality of poultry. The authorities in every state having a considerable amount of poultry will sooner or later find that it will be necessary to provide contest facilities in order that its poultrymen may not be handicapped in competition with the more fortunate breeders in other states where contests are established.

The states are under economic and moral obligations to provide for the residents of the state the educational and financial advantage which are afforded by egg-laying contests. The contest is an important educational project in the field of agricultural extension.

TABLE 37

VARIATIONS IN THE AVERAGE ANNUAL EGG PRODUCTION FOR 51 WEEKS AT TEN U. S. EGG-LAYING CONTESTS 1929 INDICATE THAT THERE ARE STILL SOME FACTORS NOT YET FULLY UNDER CONTROL

Location of Contest	Egg Production
1. Northeast	152.7
2. Northeast	179.4[1]
3. North Central	205.9
4. Southwest	203.4
5. C. Atlantic	200.6
6. Northeast	172.3[1]
7. South	197.1
8. South	203.7
9. Northeast	204.9
10. Northwest	204.5

[1] 47 weeks.

A study of the curves of monthly average egg production of ten official egg-laying contests located in widely separated regions of the United States for the year 1929, shown in Fig. 205, reveals a wide variation in production per month and per year. The difference in annual production can not be attributed entirely to climate, since the six contests making an average production of 200 eggs or more are located in the most widely separated parts of the United States, Northwest, Southwest, South, Northeast, North Central and Atlantic Central, while the three lowest in annual production are located near one of the contests making a high record.

It will prove instructive to follow the plotted curves of monthly average production. The most striking contrast in annual production was between contests 1 and 10. The former averaged less than 30 per cent production for November, whereas the latter averaged 65 per cent. Contest 1 was consistently far below all other contests until after June and for the balance of the year was below all except the lowest of the others during the last months of the contest. Contest 10 slumped below several contests for January to April inclusive and for the balance of the year maintained a high percentage above the closest competitor during closing months.

The average monthly production, no doubt, was influenced by a difference in climatic conditions. The methods of housing might be considered an important factor influencing seasonal production. However, the contest making one of the higher records has the oldest and perhaps the cheapest buildings. On the other hand, two contests which have what would appear to be the most elaborate and expensive buildings produced records of less than 200 eggs per bird. The rations fed differed in detail, as might be expected, in all of the ten contests, and this, no doubt, might account for some of the variation in production. The quality of the individual birds and the proportion of the different breeds might have made a difference in results, but this hardly could be true in this instance because many of the same contestants were in the same contests in previous years and some of them had pens in several of the ten contests where widely different results were secured from flocks by the same owners as well as for all of the birds in the contest.

The principal cause for the variation in the monthly and annual production at egg-laying contests from month to month in the same year, as between different contests, and from month to month of different years at the same contest, is the " personal equation " as involving every phase of management affecting the health and comfort of the birds.

The accuracy of this conclusion is further fortified by the fact that several of the contests making lower records in 1929 made higher records in some of the previous years and furthermore some of the " top notchers " in 1929 have had their years of low-egg production. Only a few of the contests have been able to maintain a consistent high production year after year. In a number of instances marked variations up or down in contest production can be attributed directly to change in contest management.

The breeder hazard, the loss of valuable birds, and a greater loss of prestige, on account of excusable or inexcusable lower production at some of the contests than at others, is gradually being overcome by the general improvement in contest management, and by the application of the law of "survival of the fittest" as between contests and contest managers as well as contestants.

The responsibility for contest results, it should be understood, does not rest entirely upon contest management. The skill used in breeding, selection, sanitation and pre-contest management is becoming almost a dominant factor in producing monthly and annual contest records. Here again is shown the necessity of good cooperation, correct methods and high ideals, both on the farm and at the contest. There is a dual responsibility which now is approaching a special field calling for the soundest science and most expert skill. The more valuable the birds the greater is the skill required to handle them. The greatest triumph of the breeder and the highest accomplishment of the manager meet at the egg laying contests.

EGG-LAYING CONTESTS IN THE UNITED STATES

Alabama, Auburn
Arizona,[1] Tuscon
California (Petaluma), Petaluma
California (Southern), Pomona
California (Santa Cruz), Santa Cruz
California (San Joaquin Valley), Selma
Colorado, Fort Collins
Connecticut, Storrs
Florida, Chipley
Georgia, Athens
Illinois,[1] Kankakee
Illinois,[1] Quincy
Illinois,[1] Murphysboro
Illinois[1] (Yeast Foam), Glen Ellyn
Iowa,[1] Des Moines
Kansas,[1] Partridge
Louisiana, Baton Rouge
Maryland, College Park
Michigan, East Lansing
Missouri National, Mountain Grove
Missouri State,[1] Mountain Grove
Nebraska,[1] Clay Center
New York, Farmingdale, Long Island
New York[2] (Central), Horseheads
New York[2] (Western), Stafford
New Jersey (Hunterton), Flemington
New Jersey, Passaic
New Jersey, Vineland
Oklahoma, Stillwater
Oklahoma (Panhandle), Goodwell
Pennsylvania, North American, Morton
Texas National, College Station
Texas Tarleton, Stephenville
Texas Southwestern, San Antonio
Utah Intermountain, Logan
Washington, Puyallup
West Virginia State,[1] Charlestown

[1] Not in the official Contest Record of Performance.
[2] Under construction—1930.

EGG-LAYING CONTESTS IN CANADA

Alberta, Lethbridge
British Columbia, Agassiz
Canadian, Ottawa, Ontario
Manitoba, Brandon
New Brunswick, Fredericton
Nova Scotia, Nappan
Nova Scotia Southern, Kentville
Ontario, Ottawa
Prince Edward Island, Charlottetown
Quebec Eastern, St. Anne
Quebec Western, Lennoxville
Saskatchewan, Indian Head
Vancouver Island, Sydney, British Columbia

(6) *The 4-H Clubs.*—One of the most far-reaching movements for poultry improvement is the rapid growth of the boys' and girls' poultry club work. Personally owned and handled flocks of pure-bred poultry by many thousands of boys and girls in the United States is one of the most potent influences of the time for poultry improvement.

(7) *Home Flock Records.*—The keeping of home flock records is a liberal education in efficiency of management and breeding. It has a dollar and cent motive. The result is inevitable that better and better quality of poultry will be kept.

(8) *Disease Eradication.*—The two principal diseases which are especially involved in eradication programs are Pullorum Disease (B.W.D.) and Tuberculosis. For the detection of each of these diseases sufficiently reliable tests have been developed to justify their application to flocks with the object in view of creating farms and localities as sources of stock, eggs and chicks that have been officially tested. In certain states the official tests have been applied for many years at large expense of the owner and of the state. In those states the same term has been used to designate officially tested poultry as of cattle which have been officially tested for tuberculosis, namely, the term "accredited" and by prefixing the letters T. B. for Tuberculosis tested, that is, T. B. Accredited cattle.

In the case of poultry which has been tested for tuberculosis it would be "T. B. accredited poultry," or if tested for Bacillary White Diarrhea it would be "B. W. D.," or according to the term recently adopted for this disease, "Pullorum," the term would be "P. accredited."

The occasion for the long-drawn out controversy regarding the multiple use of the word "accredited" hinged upon the importance of avoiding confusion in the minds of poultrymen due to the many grades of stock to which the word accredited was applied in various parts of the country.

The method of administration of the many types of disease eradication projects is through the veterinary colleges, veterinary departments of agricultural colleges or the departments of agriculture or cooperatively between two of these agencies. Elaborate and highly specialized modern facilities are established in many states for handling this important service in a scientific manner.

(9) *Poultry Shows.*—The poultry shows at fairs are handled principally through the state departments of agriculture. Poultry shows as separate enterprises are managed for the most part as private or cooperative enterprises but frequently with state financial support.

They have performed an important service through education and sales promotion. They still occupy a useful place among the important poultry improvement projects. Their popularity, however, has declined. This is partly due to a shift of interest from the fancy to production in the evolution of birds. The decline to a large extent is due also to the rapid and extensive increase in competitive attractions. Moving-picture shows, the radios, automobiles and airplanes all have a part in dividing interest and diverting attention from poultry shows. These attractions have had a similar effect upon many other types of exhibition.

The successful poultry show of the future must widen its appeal. It must give at least equal consideration to the many grades of production classes. Many classes can and should be offered for birds with official record of performance or contest records. These prizes should be 1st, 2nd, 3rd, etc., for ribbons, cash, display and sweepstakes, the same as now offered for standard classes. It is not sufficient and wholly unworthy of the value of the birds to merely award terms of " excellent," " commended " and " highly commended," etc.

The constantly increasing number of breeders who are producing larger and larger numbers of higher and higher quality birds both as regards production and standard qualities will insure from the start a new lease of life to the poultry shows. Such a policy may reasonably be expected to increase entries and attendance, and these two will insure larger commercial exhibitions.

(10) *Egg and Poultry Inspection Service.*—This project, although within the field of marketing, is one of the most impelling in its influence upon improvement in breeding. Higher standards of quality of eggs and poultry increase consumption which enlarges the demand, raises the price and results in larger profits. All of these in turn stimulates improvement in breeding in order to produce the higher and more profitable quality.

The division of marketing of the Federal bureau of agricultural economics has developed national standards of poultry and egg grades which are gradually being adopted by the states in full or in part. New York State has such an egg-grading law which is working to the distinct advantage of consumers, distributors and producers.

PART FOUR

GENERAL INFORMATION

GLOSSARY

Abdomen—The rear region of the body located between the ends of the pubic bones and the posterior (rear) end of the breast bone.

Anatomical characters—Those characters which are determined by the bony framework of the body and which are relatively fixed.

Axial feather—The short feather in the middle of the wing that separates the primaries from the secondaries.

Beak—The horny projecting mouth parts of chickens, including the upper and lower mandible.

Bleaching—The disappearance of yellow pigment from the visible parts of a bird.

Body type—The outline of a bird when seen from any direction, and as determined by handling.

Breeder—This term is used to designate a poultryman who breeds and reproduces his own birds. It is also used to designate individual birds, male or female, which are used for breeding purposes.

Breed characters—Characters which are used to distinguish between different breeds. Size and shape are the two most common characters used in making this distinction.

Broodiness—The tendency of hens to incubate eggs.

Capacity—The internal cubical content of the body. This is commonly estimated by the distance from the pubic bones to the end of the breast-bone.

Capon—A male bird from which the primary sex organs have been removed.

Carotin—A ruby-red pigment found in plants, and in certain parts of individuals of the bovine family.

Certified—A term which is used to designate varying degrees of quality in different states and by different organizations. The usual meaning of the term when applied to breeding stock refers to high quality females selected by physical examination and males whose dams laid 200 eggs or more.

Character—A recognizable attribute of a bird such as structure, form, substance, color or size.

Cock—A male chicken over one year of age.

Cockerel—A male chicken under one year of age.

Commercial layer—A hen maintained for the production of market eggs.

Constitutional vigor—The physical manifestations of vitality and health.

Copulation—The act of mating.

Corium—The inner layer of the skin.

Correlation—A numerical expression of the manner in which two or more characters vary with respect to each other.

Cull—An inferior bird, either for meat or egg production.

Culling—The practice of removing unprofitable birds from a flock.

Cycle—The number of consecutive days that a bird lays without a skip.

Depth, front—The measurement from the front end of the keel to a point on the middle of the back directly above.

Depth, rear—The measurement from the rear end of the keel to a point on the middle of the back directly above.

Dormant condition—The condition of a bird when not producing eggs.

Down—The first plumage of a baby chick. This is replaced by feathers.

Egg-feed ratio—The price of feed per 100 pounds divided by the price of eggs per dozen.

Egg-laying contest—A contest where entries of birds of different breeds and from many different poultrymen compete in the production of eggs under the same conditions of environment and management.

Egg production, annual—The number of eggs produced by a bird in one year from the date of the first egg laid in the case of pullets, or from the first egg by a hen after recovery from the molt.

Egg production, distribution of—The manner in which a bird distributes her eggs with respect to time.

Egg production, winter—Usually interpreted to mean the production for the months of December, January and February; sometimes considered as the production prior to March 1st.

Earlobe—The fleshy, unfeathered growth under the ear.

Egg type—A type of bird which is an efficient transformer of feed into eggs.

Epidermis—The outer layer of the skin.

Exhibition—Commonly used in referring to displays or shows of stock or products. It is also used to designate birds bred in accordance with the American Standard of Perfection.

Eyering—The edges of the eyelids.

Fertilization—The union of male and female germ cells.

Function—The particular role which a character performs in the life of a bird.

Handling quality—The condition of the bird as determined by the thickness, pliability and looseness of the skin and the softness of the fat beneath the skin.

Head type—A composite term including the shape of the skull and other visible characteristics such as expression and physical condition.

Heart girth—The width of the body from the attachment of the wings backward throughout the region of the ribs.

Hen—A female chicken over one year of age, or a bird in her second or later laying years.

Hock—The knee joint.

Intensity—The number of eggs produced by a bird in a given time as one week or one month.

Judging—The placing of birds according to their merits when compared to some recognized, or accepted, standard.

Keel—The breast-bone of a bird.

Lateral processes (Sternal processes)—Two long, slender bones extending along either side of the body just above the level of the keel and attached to this bone at the anterior (front) end.

Laying condition—The condition of a bird when producing eggs.

Laying temperament—The behavior of a bird as expressed in activity, alertness and friendliness.

Loin—The section of the back of the bird between the last dorsal vertebra and the hips.

Maturity, sexual—A female is sexually mature when she lays her first egg; a male when he produces sperm capable of fertilization.

Maturity, physical—The time at which a bird reaches maximum growth.

Meat type—A type of bird which is an efficient transformer of feed into poultry meat.

Molt—The process of changing old feathers for new.

Nervous energy—The driving force of the nervous system as expressed by physical action.

Net correlation—A correlation which measures the relationship between two characters when the effect of all other characters is held constant.

Official supervision—Involves inspection by employees of one or more recognized official State and Federal agencies, the State College of Agriculture representing education, the State Department of Agriculture representing regulation.

Oviduct—An accessory reproductive organ secreting the albumen, two shell membranes and the shell of an egg.

Pelvic arch—The span or distance between the ends of the pubic bones.

Persistency—The continuance of production for a long period. It is especially applied to late fall production.

Physiological characters—Those characters which are variable due to egg production, disease or other cause.

Plumage—A collective term referring to all the feathers covering a bird's body.

Precocity—The tendency to develop rapidly and to lay at an early age.

Prepotency—Greater capacity on the part of one of the parents as compared with the other to transmit his or her own characteristics to the offspring.

Primaries or flights—The large feathers forming the outer section of the wing when spread out from the body. There are usually ten primaries.

Procreation—The act of reproduction.

Production balance—The adjustment of body weight to the volume of eggs produced.

Pubic bones—Two slender, flat bones at the posterior (rear) end of the pelvic region terminating on either side of the vent.

Pullet—A female chicken under one year of age. The entire first year of production is spoken of as the pullet year.

Pullorum disease—A disease affecting young chicks (also known as Bacillary White Diarrhea).

Record of performance—When applied to breeding females refers to hens which have laid 200 or more eggs of desirable size, shape and color in their first laying year, under official supervision. When applied to males the term refers to cockerels or cocks from Record of Performance dams with records of 225 eggs or more.

Reddish horn—A color found in parts of the beak and shanks of certain breeds such as the Rhode Island Reds.

Rhythm—The frequency with which cycles are repeated.

Secondaries—The large feathers forming the inner section of the wing when spread out from the body. They practically cover the primaries when the wing is folded. There are usually fourteen secondaries.

Selection—The separating out of desirable layers or superior males and females which are to be mated and the progeny used for the purpose of replacing the birds removed from the flock each year.

Sex characters, primary—The ovary and testes and accessory organs.

Sex characters, secondary—The characters such as the comb, wattles, earlobes, spurs, shape of feathers, and sickle feathers, the first two of which especially reflect the activity of the primary sex organs.

Sex dominance—Indications of maleness or femaleness.

Sex-linked characters—Characters which are transmitted to the progeny by one sex only.

Shank—The part of the leg between the hock and the foot.

Spur—The horn-like growth on the shanks of males and occasionally females.

Standard—An ideal. Commonly used in referring to the breeds and varieties of birds recognized by the American Poultry Association.

Supervised—A term when used in referring to breeding stock designates the lowest grade of officially banded birds recognized in many states.

Symmetry—Proper proportion of parts.

Varietal characters—Characters which are used to distinguish between different varieties of the same breed. The characters most commonly used are color of plumage and comb type.

Vent—The common opening of the alimentary and genito-urinary systems.

Winter pause—A rest period of more than one week's duration following the termination of the winter laying period and prior to the beginning of the spring laying period.

Xanthophyll—A yellow pigment found in the leaves of green plants, a few grains, fatty tissues of poultry and the yolks of eggs.

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